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THE PROBLEM OF ZEBRA MUSSEL INFESTATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON WATER RESOURCES,
TRANSPORTATION, AND INFRASTRUCTURE

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

MAY 19, 1990—ALEXANDRIA BAY, NY
JUNE 23, 1990—DUNKIRK, NY

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THE PROBLEM OF ZEBRA MUSSEL INFESTATION

SATURDAY, MAY 19, 1990

U.S. Senate,
Committee on Environment and Public Works,
Subcommittee on Water Resources,
Transportation and Infrastructure,
Alexandria Bay, NY.

The subcommittee met, pursuant to notice, at 10:30 a.m., at Bonnie Castle Resort, Alexandria Bay, NY, Hon. Daniel Patrick Moynihan (chairman of the subcommittee) presiding.

Present: Senator Moynihan.

Also present: Representative Martin.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator Moynihan. A very good morning to our guests and our witnesses. This is a regularly scheduled meeting of the Subcommittee on Water Resources, Transportation and Infrastructure of the Senate Committee on Environment and Public Works.

I am Senator Moynihan, and I am accompanied by my friend and colleague from the other Congressional body, Mr. David Martin.

The subject of our hearing is the appearance of the zebra mussel in the Great Lakes system, and in the St. Lawrence River.

These mussels now spread from here as far west as the Great Plains. They first arrived in 1986, I think we agree on that. They began to show up last year, and the possibility of an enormous infestation is very real and present.

For what its worth, it comes under the heading of every time you solve one problem, you get another one.

The reason the zebra mussel never made its way into our water system from Europe, where it spread in the canals from central Russia is that the harbors in Europe were so polluted that the mussel could not live.

They cleaned up the harbors, the next thing you know they had the mussels, and the next thing you know, the mussel was here.

Let me put in a statement by Senator Glenn at this point.

[Senator Glenn's statement follows:]

STATEMENT OF HON. JOHN GLENN, U.S. SENATOR FROM THE STATE OF OHIO

Mr. Chairman, I would first like to thank you for holding this hearing on my bill, S. 2244, "The Non-indigenous Aquatic Nuisance Act of 1990", of which you are an original cosponsor. Your prompt action in doing so will facilitate the passage of legislation that will prevent new introductions of aquatic nuisance species into US waters and bring relief to those areas already infested with organisms such as the Zebra Mussel in the Great Lakes.

Mr. Chairman, we in the Great Lakes region have a problem. The zebra mussel infestation in our lakes is already costing us millions. In fact, some estimates are as high as five billion dollars by the turn of the century. The following is a list of examples of the Zebra Mussel crisis within the Great Lakes region:

—Monroe, Michigan, was without water last December, due in part to the presence of zebra mussels in the water inlet pipes. This community needs three million dollars right away to deal with the problem.

—Cleveland Electronic and Illuminating is budgeting between two and four million dollars for clean up and pipe redesign.

—The fishery in Lake Erie alone is estimated to lose as much as two billion dollars over the next ten years if the zebra mussel population alters the lake ecology as expected.

—The BP Petroleum Processing Plant in Toledo, Ohio has Zebra Mussels in the water inlet lines. Right now they are most concerned about this organism plugging up the water lines in the fire system. You can only begin to imagine the sort of crisis Toledo would face should there be a fire in this plant which could not be put out because the water lines were clogged with Zebra Mussels.

—In an attempt to slow the spread of Zebra Mussels into the water supply, the city of Galion, Ohio has already closed three upground reservoirs to all boaters. Three other cities are considering a similar action for their water supply reservoirs. This is not only a loss of recreational facilities, but an economic loss as well. Yet, how can we condemn the city planners, when they face the phenomenal costs of retrofitting and pipe clean out.

Mr. Chairman, today in the State of Ohio, we are facing innumerable problems. We have to make decisions about the use of chemical controls which have to balance the short term utility with long term environmental effects. We have to balance the threat of Zebra Mussels spreading into water systems with the public right of access to reservoirs and lakes. We are dealing with plugged inlet pipes that can cause a loss of water, electricity, or commercial production. The potential exists for this organism to give our water a foul taste and smell. The beaches of Ohio are already littered with the unsightly sharp shells of the Zebra Mussels. Our tourism and sport fishing industries are already threatened.

In spite of our best efforts to prevent spread of the Zebra Mussel throughout the national water system, they are expected to reach the Ohio River some time this year. Ohio and New York and the rest of the Great Lake states and Canada are not the only places that are going to be affected by this nuisance species. Once it crosses the boundaries into the Ohio/Mississippi Drainage basin, it will move throughout the United States. Each new community that is infested will face the same problems.

My bill was introduced March 7, 1990 to facilitate an effective response to the Zebra Mussel and other aquatic nuisance species, but also more importantly, to prevent new nuisance species from becoming problems. It is designed to prevent the problems that arise when exotic species are introduced into US waters by requiring ballast water management regulations; it also provides a mechanism for and authorizes funding to deal with the research and control problems caused by those aquatic nuisances once they become established in US waters. My bill provides a system for handling the exotic species problem now and in the future. It encompasses both salt and fresh water ecosystems. My bill covers prevention as well as response and it covers aquatic nuisance species generally, not just Zebra Mussels.

Title I is the most important title in the bill. It calls for the US Coast Guard to regulate ballast water of ships coming into US waters. This is ballast water management, not necessarily high seas ballast exchange. We have new organisms being transported into US waters all of the time. The most recent example is the Tube-nosed goby, a small fish that was discovered in the St. Claire River three weeks ago. In my legislation, I call for the institution of ballast water management practices for all ships entering US waters. I realize that this is a new field and that we do not have all of the answers yet, but we cannot sit still and do nothing. We know from the research of people such as James Carlton of the Maritime Studies Program at Williams College that exchange of ballast water at high seas minimizes the risk of establishing populations of live organisms transported in ballast water. The statistical odds of picking up organisms are lower and those organisms that are picked up at high seas are less likely to survive when deballasted into fresh, brackish or near shore environments. There is no reason for ships that normally cross high seas under conditions which allow for ballast exchange not to do so.

This is a stopgap measure that will minimize the risk of a new Zebra Mussel while we develop even better methods of ballast water management. The provisions of S. 2244 reflect the necessity of updating the ballast water management regulations to reflect existing technology. Furthermore, this legislation was developed to reflect the concerns of shippers who do not normally go to high seas. A laker going from Duluth to Toledo does not have to go out to high seas to exchange ballast before entering the port of Toledo. This laker, however, will have to carry out other management practices as recommended and approved by the Coast Guard. Likewise, ships carrying oily ballast or other ballast water that is normally deballasted to onshore treatment facilities are not required to exchange ballast water at high seas. The onshore treatment is sufficient to kill any live organisms and we do not need to add any more pollutants to the oceans of the world.

The regulation of ballast water is a task best suited to the US Coast Guard. Working in conjunction with the experts at the US Fish and Wildlife Service, the Coast Guard will devise a statistical sampling procedure that can determine whether or not proper ballast water treatment or exchange occurred. Any ships that are noncompliant will be fined and not allowed to dump their ballast water near shore. Simply requiring the first few offenders to return 200 miles offshore and exchange ballast, or go through costly onshore water treatment along with a fine, will quickly get the word out that we are serious and will not tolerate new ballast water introductions of aquatic nuisance species.

Mr. Chairman, we in the Great Lakes region are faced with the Zebra Mussel crisis. Each state in the region is now faced with independently dealing with this aquatic nuisance species. Many other regions, such as the Northwest, Hawaii, Florida and the Northeast, have similar problems. Our task is to respond to a crisis with the least waste of our limited resources while using the most effective techniques available. We need to coordinate individual efforts and provide a source of federal funding to carry out research on aquatic nuisance organisms. Title II of S. 2244 provides the framework needed for such a coordination effort. As much as we would like to give the responsibility for dealing with acquatic nuisance species to one agency—the way the USDA manages the Mediterranean fruit fly eradication efforts—no single agency is equipped to manage all aspects of aquatic nuisance species. The US Fish and Wildlife Service and the National Oceanic and Atmospheric Administration are each able to deal with different aspects of problems associated with non-indigenous species. S. 2244 divides the work load between these agencies in a way that is uniquely suited to the capabilities of each agency. The Fish and Wildlife Service is best suited to long term tracking and monitoring and whole ecosystem studies. The Sea Grant College Program and Marine Advisory Service are best suited to university research programs, public education and industrial applications. Research assignments are flexible to maximize the use of existing facilities and resources.

Because we have an immediate and pressing problem within the Great Lakes and because we share this problem with Canada, we need to take some special immediate actions in this region. We call upon the Great Lakes Fishery Commission to participate in our coordination effort to facilitate interactions with Canada. We also require that the Zebra Mussel be declared an injurious species so that we can use existing regulations to control the intentional transport of this organism.

Mr. Chairman, we need to act now. Our most important need is a system that will work for us now and in the future. We must prevent new ballast water introductions of these harmful non-indigenous species. Since I introduced my legislation, another exotic species has been identified in the Great Lakes, the tube-nosed goby. This is proof positive that we now have an open invitation to acquatic nuisance species to hitch a ride to the clean waters of the United States where they can proliferate. We must act immediately to use all of the techniques we have available to lessen the immediate risk of introductions while we work on developing better ballast water management methods. The very livelihood of our sport and commercial fisheries as well as our commercial investments are at stake. But even more important than our own economic concerns is our failure in our stewardship of the natural environment. Each time a non-indigenous species displaces a native species, we lessen the natural gene pool and lose another battle in the fight to preserve biodiversity. We cannot wait any longer to stop the damage and protect our water resources. I urge that you move my bill—with its prevention and coordination titles—through the Environment and Public Works Committee as rapidly as possible. Thank you again for all of your efforts.

Senator MOYNIHAN. I would now like to welcome Mr. Martin.

STATEMENT OF HON. DAVID MARTIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. MARTIN. Thank you very much, Senator Moynihan. On behalf of all the people along the river I want to welcome you back to the beautiful St. Lawrence and Lake Ontario. In that connection I would like to point out that I think it would be appropriate if we had another hearing on this subject and schedule it sometime in August.

I predict that this will be the year that my boat will work, and I will be more than happy to squire you around the St. Lawrence upon your return.

It is very important to note at this time—I think people ought to appreciate it—your leadership on this subject. You are the chairman of the subcommittee, and you are very knowledgeable on the subject.

You are working together with the other Great Lakes Senators and members of the House—Marcy Kaptur, Henry Nowak and those folks. Once we have the necessary knowledge, we might be able to enact legislation that makes sense.

I have a statement here from the junior Senator, Mr. D'Amato, who is also very interested in this subject, and will be up here on the Lakes in short order. I ask unanimous consent that his statement be entered into the record in its entirety.

Senator MOYNIHAN. Without objection.

[The prepared statement of Senator D'Amato follows:]

Alfonse D'Amato

STATEMENT BY SENATOR ALFONSE M. D'AMATO
SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
SUBCOMMITTEE ON WATER RESOURCES, TRANSPORTATION
AND INFRASTRUCTURE
FIELD HEARING ON ZEBRA MUSSELS
BONNIE CASTLE RESORT
ALEXANDRIA BAY, NEW YORK
MAY 19, 1990

MR. CHAIRMAN, I WOULD LIKE TO COMMEND YOU FOR HOLDING THIS FIELD HEARING TODAY. THE THREAT POSED BY THE ZEBRA MUSSEL IS REAL. TODAY'S HEARING WILL BE HELPFUL IN OUR EFFORTS TO CONTAIN AND FINALLY ELIMINATE THIS SPECIES FROM THE GREAT LAKES.

THE ZEBRA MUSSEL IS BELIEVED TO HAVE ARRIVED IN NORTH AMERICA IN THE BALLAST WATER OF A EUROPEAN FREIGHTER IN THE SUMMER OF 1986, AND ESCAPED AS LARVAE IN DISCHARGED BALLAST WATER INTO LAKE ST. CLAIR OR THE ST. CLAIR RIVER. SINCE THEN THE PROBLEM HAS GROWN IN MAGNITUDE SPREADING TO LAKE ERIE, LAKE ONTARIO, GREEN BAY, OFF OF LAKE MICHIGAN, AND ALSO DOWNSTREAM IN THE ST. LAWRENCE RIVER.

THE MUSSEL IS ATTRACTED TO MUNICIPAL WATER INTAKES, CLOGGING THE SYSTEMS AND FORCING EXPENSIVE REPAIRS JUST TO KEEP WATER FLOWING FROM THE TAPS OF HOMES AND BUSINESSES. THE MUSSEL HAS ALSO BEEN FOUND AT NIAGARA MOHAWK POWER CORP'S DUNKIRK GENERATING STATION, WHERE OFFICIALS ARE WORRIED THAT THE SHELLFISH COULD REDUCE POWER GENERATION PERIODICALLY. OFFICIALS IN DUNKIRK AND STURGEON POINT HAVE ESTIMATED THAT REPAIR COSTS COMBINED WITH THE MUSSEL'S IMPACT ON THE SPORT FISHING ECONOMY COULD COST THE REGION ABOUT $500 MILLION A YEAR.

OBVIOUSLY THERE IS GREAT CONCERN THAT THE ZEBRA MUSSEL COULD SPREAD TO WATERWAYS ACROSS MUCH OF THE UNITED STATES. THE MOST IMMEDIATE THREAT IS THIS MUSSEL'S POTENTIAL FOR MOVEMENT THROUGH THE ERIE CANAL INTO THE HUDSON RIVER AND THE FINGER LAKES OF NEW YORK STATE.

YESTERDAY, I JOINED WITH SENATOR MOYNIHAN IN INTRODUCING THE "ZEBRA MUSSEL ERADICATION, REDUCTION AND OBVIATION ACT OF 1990". I HAVE ALSO COSPONSORED OTHER LEGISLATION WHICH WILL FUND RESEARCH AND CONTROL ACTIVITIES TO HALT FURTHER ZEBRA MUSSEL INFESTATION.

THE MAGNITUDE OF THIS PROBLEM HAS MADE IT CLEAR THAT WE MUST ACT NOW TO ADDRESS THIS SERIOUS PROBLEM. PROSPECTS FOR LEGISLATIVE ACTION THIS YEAR TO COMBAT THE ZEBRA MUSSEL ARE EXCELLENT. I AM WORKING WITH THE OTHER MEMBERS OF THE GREAT LAKES TASK FORCE IN OBTAINING THE NECESSARY FUNDING TO SUCCESSFULLY TACKLE THIS PROBLEM. I AM CONFIDENT THAT WE WILL ULTIMATELY WIN IN OUR EFFORTS TO ERADICATE THE ZEBRA MUSSEL FROM NORTH AMERICA.

Mr. **Martin**. I know the legislation we want to have passed will make sure that other creatures are not introduced into our waters by having ships pump ballast water out on the high seas rather than waiting to get in here.

It is not going to resolve this problem, but perhaps it can resolve future problems.

Senator **Moynihan**. Senator Glenn has a companion measure in the House. We are speaking, of course, for the whole of the Great Lakes region here.

Mr. **Martin**. Absolutely.

Senator **Moynihan**. I have a letter from the Northeast-Midwest Coalition signed by Senator Durenberger from Minnesota, which is the Great Plains, Senator Glenn, Senator Kasten, Senator D'Amato, Senator Dixon, Senator Cohen, Senator Heinz, Senator Metzenbaum, Senator Lugar, Senator Levin and Senator Specter. I will put that into the record at this point.

[The letter referred to follows:]

SENATE
COALITION

Great Lakes Task Force

Task Force Co-Chairmen
Dave Durenberger
John H. Glenn, Jr.

April 30, 1990

The Honorable Daniel Patrick Moynihan
United States Senate
Washington, DC 20510

Dear Pat:

We, the undersigned members of the Senate Great Lakes Task Force, are writing to request that you chair a hearing on S.2244, the "Non-indigenous Aquatic Nuisance Act of 1990." S.2244 was introduced on March 7, 1990, with your cosponsorship and, as you know, was referred to the Committee on Environment and Public Works. We hope to move this bill as quickly as possible. In your capacity as chair of the Subcommittee on Water Resources, Transportation, and Infrastructure, you could facilitate this movement by chairing a hearing on S.2244 either here in Washington or in the field.

As you know, the Zebra mussel, a small clam-like organism, has infested the Great Lakes and is already estimated to cost us five billion dollars over the next ten years. If left unchecked, Zebra mussels are expected to spread throughout two-thirds of the United States. We must act quickly to prevent new introductions of other aquatic nuisance species and to provide research and control money for the Zebra mussel and other established non-indigenous species.

If the Senate Great Lakes Task Force staff can be of any assistance in facilitating this process, please do not hesitate to let us know or to call Allegra Cangelosi or Charlene Waggoner at 224-3353. We strongly believe that S.2244 must be passed as soon as possible and appreciate very much your consideration of this matter.

Sincerely,

Dave Durenberger
David F. Durenberger,
Co-chairman, Senate Great
Lakes Task Force

John Glenn
John Glenn,
Co-chairman, Senate Great
Lakes Task Force

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Bob Kasten
Bob W. Kasten

Alan J. Dixon
Alan J. Dixon

Alfonse D'Amato
Alfonse M. D'Amato

Herb Kohl
Herbert Kohl

John Heinz
John Heinz

Howard Metzenbaum

Dick Lugar
Richard G. Lugar

Carl Levin
Carl Levin

Arlen Specter (Zebra Mussel hearing ESC 5/2/90)
Arlen Specter

Senator MOYNIHAN. We have the great pleasure this morning of having the very able Chief of Engineers for the Buffalo District, Colonel Boyd open our hearing. As you know, the basic thought in our legislation is that we will, while this problem is still in its larval stage, want to get to work on finding some means of control. We have done that before. We have been able, I think with some success, to deal with the sea lamprey, which was on the verge of destroying the fisheries on the Great Lakes.

This has an equivalent possibility, and we would like to hear from you, sir, and from Mr. Gerard LeTendre, who is the Supervising Aquatic Biologist at the Cape Vincent Fish Research Station, of the New York State Department of Environmental Conservation, and who is bearing samples. We also will hear from Marg Dochoda, who is a Fisheries Biologist with the Great Lakes Fishery Commission.

Colonel Boyd, why don't you begin, and we will move across in that direction? We welcome you, and Mrs. Boyd and your daughters.

STATEMENT OF COL. HUGH F. BOYD, BUFFALO DISTRICT ENGINEER, U.S. ARMY CORPS OF ENGINEERS

Colonel BOYD. Good morning, Senator, to you and to Mr. Martin.

I am Colonel Hugh Boyd, the Buffalo District Engineer of the U.S. Army Corps of Engineers. I am pleased to be here this morning on behalf of the Secretary of the Army to discuss zebra mussel control. The goal of my statement is to inform the subcommittee of the Corps' knowledge of the zebra mussel and the problems it poses to the Great Lakes infrastructure projects.

The invasion into the waters of the Great Lakes by the zebra mussel has created much concern by all of us who live and work in the basin and by the agencies whose responsibilities involve those waters. The explosive growth of the zebra mussel parallels that which occurred in European lakes.

While its effect on the food chain is expected to be adverse, its effect on water intake pipes and other structures is of immediate concern. Every community on Lake Erie with whom I have had contact has found zebra mussels on their water intake pipes. The solution to their control, to the best of my knowledge, has been elusive and may not be easily discovered.

The Buffalo district is currently participating with the Commonwealth of Pennsylvania in one of their studies to learn more about the effects of the zebra mussel. That particular group has just begun its work and it is more of a fact-finding mission than anything else.

Mr. Chairman, that concludes my formal remarks. I will be happy to answer any questions you may have.

Senator MOYNIHAN. I will get back to you. As you know, the legislation we have in our committee now directs the Corps to develop a program of research and technological development on this issue. I would like to hear from you specifically on the subject of the Corps and how you perceive that mission.

Mr. LeTendre, good morning, sir, and it is very good of you to come here. I see you come bearing bottles.

STATEMENT OF GERARD LeTENDRE, SUPERVISING AQUATIC BIOLOGIST, CAPE VINCENT FISH RESEARCH STATION, N.Y. STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Mr. LETENDRE. Good morning, Mr. Chairman. My name is Gerard LeTendre, Supervising Aquatic Biologist, Lake Ontario Unit Leader, of the Cape Vincent Fish Research Station, of the New York State Department of Environmental Conservation.

Thank you for giving me the opportunity to testify on your bill, and to address the problems caused by the introduction and proliferation of the zebra mussel in the Great Lakes system.

Since this organism may eventually invade other major watersheds in the United States and Canada, it is an issue which requires Federal oversight, support and international coordination. Section 5 of your bill would require the Secretary of the Army, in consultation with the Director of the United States Fish and Wildlife Service, and the EPA administrator, to develop and design a research and technology program to control zebra mussels in and around public infrastructure facilities.

We welcome this Federal initiative, but we urge that control technologies to prevent or remove zebra mussel encrustation on infrastructure be carefully developed to avoid the significant environmental damage that biocides and various structural alternatives could cause.

Section 6 of your bill would allow the States to develop management programs to identify public infrastructure facilities affected by zebra mussel encrustation and to reduce infestation. Section 7 would allow the Secretary of the Army to give 50-50 matching funds to States which have approved management programs to assist them in implementing their programs. Section 8 would authorize $5 million to the Secretary of the Army for each of the fiscal years from 1991-1995 to carry out the foregoing sections. We support these sections of your bill.

Section 9 authorizes the Secretary of State to make available to the Great Lakes Fishery Commission, if required by the U.S. section, money to establish and implement a program to manage and control zebra mussels in the Great Lakes. It is appropriate for the Great Lakes Fisheries Commission to coordinate research and to develop management and control techniques, as needed. However, the bill does not authorize any appropriation for this purpose.

Currently, the Commission's sea lamprey control program is underfunded and it cannot achieve treaty mandates. It will be seeking additional funds to embrace existing controls and to develop alternative control technology to eliminate the total dependence on chemicals as a sea lamprey control method. Commission resources should not be diverted from the sea lamprey program. We strongly urge you to authorize appropriate funding for the zebra mussel initiative and to support the Commission's request for additional funding for the lamprey eradication program.

Once again, thank you for giving me the opportunity to testify here. I would be happy to answer your questions on the zebra mussel.

Senator MOYNIHAN. I am a little puzzled. It specifically states that there is authorized to be appropriated to the Secretary of

State to carry out the provisions of subsection 8, $2.5 million dollars for each of the fiscal years 1991 and 1992, and each fiscal year thereafter, such supplements as may be necessary. I think we do provide for appropriations. If we don't, we should, and will. We can't ask you to do something and not give you money to do it.

Although I hear you on the lamprey matter, but maybe you could arrange to send us something in writing from the Commission on that. We will get back to you.

Ms. Dochoda, good morning. Oh, you are the one who brought the samples.

Ms. DOCHODA. Yes. Shall I bring them up?

Senator MOYNIHAN. You probably should. You are bringing them up here? Your dead animals—three of them are from——

Ms. DOCHODA. This is from Lake Erie near a power station. It shows how they get into the pipes.

Senator MOYNIHAN. What would Mr. Martin call them?

Mr. MARTIN. We are going to be very bright before this day is over.

STATEMENT OF MARG DOCHODA, FISHERIES BIOLOGIST, GREAT LAKES FISHERY COMMISSION

Ms. DOCHODA. The reason I brought these creatures along is to briefly demonstrate that biological pollution is forever, extinction, invasions of a large open system like this is forever. We are not going to get rid of these critters. The sea lamprey, the ruffe, the zebra mussel—we are going to be living with these forever, compared to a chemical or oil spill, where in 100 years, the effect is obliterated. These things will be with our great-great-grandchildren.

They observe no borders. The zebra mussel, we expect, will be in every major river system in the United States, being spread by ducks feeding and bottoms of boats, and those kinds of things. It took them 100 or 200 years to spread in Europe.

The ruffe right now is confined to Duluth Harbor, but it is very often spread in Europe in bait buckets, as bait fish, so we expect that will be spread, albeit more slowly. Both of those came into the ballast of ocean-going vessels coming from Europe.

The point of this is that we believe the Commission and fishery agencies are on record as believing that an ounce of prevention is worth a pound of cure for these things. It is not just the zebra mussel and the ruffe. Just a few weeks ago they discovered a new one, called a tubenosed goby. We joked that it will be keeping the mussel beds clean, but it looks like it is here, also, now.

Senator MOYNIHAN. Hold on a second. What is here now? Let's think of our faithful reporter, and spell that. Tell us what you mean.

Ms. DOCHODA. A tubenosed goby is a little fish from the Black Sea and Caspian Sea which was just discovered in the St. Clair River. We don't know if it has a reproducing population, but it is evidence that injections of foreign plants and animals are continuing.

Senator MOYNIHAN. Should we welcome the tubenosed goby? [Laughter.]

No, we don't.

Ms. DOCHODA. We hope that it will not reproduce, and be neutral in the grand scheme of things. We will be blessed if it does not reproduce and is neutral.

Mr. MARTIN. Could I interrupt for just one second? You said "something" is confined for the present time to the Duluth Harbor. Is that this creature?

Ms. DOCHODA. No, it is the ruffe next to you. The ruffe is a relative of the perch, from Europe. It does not get much bigger than that, and it has a couple of nasty habits, which we believe will affect at least the yellow perch. It will compete with the yellow perch for food, and it preys on fish eggs, and it is a voracious winter feeder. Most fish are fairly dormant during the winter time.

So it will, when it gets out of Duluth Harbor—it is thriving there now, but the cold water of Lake Superior is slowing its spread, but it will get into Saginaw Bay, Green Bay, and western Lake Erie. It will compete. You will be catching them, they will be stuck to your nets, and everything else—eventually. It is spreading more slowly.

The point is that the zebra mussel is not the only thing coming in.

Senator MOYNIHAN. But this is not going to stop the electricity supply, is it? But this one might?

Ms. DOCHODA. The ruffe is more of a threat to the fishery, uniquely. There are about 100 species of exotic plants, animals and disease pathogens in the Great Lakes that we are aware of, that have been documented. There are some scientists doing a study for us, reviewing the literature.

Amazingly to us, it turns out that about a third of them have been connected in one way or another with ballast water. This is rather recent, as you said, since maybe the 1970s, and probably has something to do with improving water quality in Europe and here. It probably also has something to do with the shortening in the length of time it takes for a ship to get back and forth between Europe and here.

Typically, right now there are about 1,000 ocean-going vessels that come into the Seaway. They can carry a discharge——

Senator MOYNIHAN. In the course of a year.

Ms. DOCHODA. Yes. They can carry—there used to be more, unfortunately, the grain and steel industry are not what they once were. But they can discharge as much as 1.25 million gallons of ballast water. It is even more in ocean-going vessels visiting the coast. It can be 6 million gallons. If you compare this with what may be in your swimming pool, 30,000 gallons, that's an awful lot of water, and it is quite capable of bringing in plants and animals from elsewhere, in numbers enough to become established in the Great Lakes.

Currently, the Canadians have a gallant band-aid attempt to prevent future introduction. They have asked the ships to voluntarily exchange their ballast before coming into the Seaway. My Commission does not believe that it is adequate, of course, when you look at the long-range implications. Last year there was 83 percent compliance. But on 1,000 ships, that translates to 170 of them who were still discharging up to 1.25 million gallons each.

Also, the Canadian guidelines only address the Seaway. That is this side of Montreal. It does not address the lower St. Lawrence River, and does not include the Hudson River, which is connected to Lake Champlain, and the Mississippi—any contiguous waters. So those are two concerns the Commission has with the current situation. There is not 100 percent compliance in these adjoining waters.

Senator MOYNIHAN. Help me there. The river that flows out of Champlain—is it Louise?—into the St. Lawrence, the outlet there is below Montreal and that ship ballast water can be discharged up to Montreal? Is that it?

Ms. DOCHODA. Ships visiting Quebec City, Montreal, Albany, and cities toward New York City are not expected to exchange their ballast. If the zebra mussel or——

Senator MOYNIHAN. If it is in that water, it will get down to the Champlain——

Ms. DOCHODA. Yes. On the bottoms of boats, going out into a stream, it will develop into larvae and sweep downstream. I am sure they will see it shortly in a few years, in the State of New York through the barge canals.

Mr. MARTIN. There is something I was going to ask the Colonel, and Jerry, you brought it up as well—the question of our legislation and how it relates to our water system, the St. Lawrence River, although once you get above Franklin County, the St. Lawrence River is in Canada.

My question is, how do the Canadians, who have every bit as much a problem and concern as we do, all the way from Quebec City to Thunder Bay—are they as concerned and are we cooperating with them in an attack on this problem?

Senator MOYNIHAN. I think we have heard here that the Canadians are in fact putting regulations in place. We have nothing.

Ms. DOCHODA. They are voluntary guidelines.

Senator MOYNIHAN. All right. But——

Ms. DOCHODA. We think it was a very good first shot. With regard to the zebra mussel, they are about in a similar situation, racing to get their response, to coordinate their response.

Senator MOYNIHAN. That's why we ought to work with the Fishery Commission.

Ms. DOCHODA. Certainly, in some ways the zebra mussel ballast introduction is very similar to the sea lamprey in that it is a common problem, it is one that the Canadians and Americans are both having to address. We were established for that purpose, and we are an instrument of both countries for addressing this sort of problem, if you care to use us for that purpose.

The Commission wanted to make the point that preventing future ballast introduction——

Senator MOYNIHAN. I don't mean to interrupt you, but this is the paper you are talking about? It says "draft".

Ms. DOCHODA. I did it yesterday.

Senator MOYNIHAN. You did it yesterday. Has it matured, or aged, overnight, and is now an official position?

Ms. DOCHODA. The positions are official.

Senator MOYNIHAN. I tell you what. We are going to put it into the record, and then you can change it. If you want to make adjustments, do so. (See p. 32.)

Ms. **Dochoda**. There may be typos. The Commission did discuss these issues, so the positions are solid. My rendition——

Senator **Moynihan**. Your spelling may not be. No problem.

Ms. **Dochoda**. The Commission wishes to, in endorsing Senator Glenn's Non-Indigenous Aquatic Nuisance Act, we wanted to point out that to us, most crucial is Title I, which would make ballast exchange and ballast treatment mandatory for all U.S. waters. I ran through a few of the reasons—because biological pollution is forever, it is expensive, it spreads, and it is one of those things where an ounce of prevention is worth a pound of cure.

Senator **Moynihan**. Zebracides.

Ms. **Dochoda**. Yes. We really don't want to get into having to use chemical control programs.

On title I, the Commission did urge that the United States coordinate with Canada in preventing future introductions. These things don't recognize borders.

Also, there is a need to protect the St. Lawrence and Canadian Rivers, and New York rivers. The Canadians may be in a better position to help you enforce your regulation, should you adopt prevention measures. They get those ships first when they come through the St. Lawrence locks there. They have first crack at them. It can be more difficult to try and enforce when you get to the ports on the U.S. side.

With regard to title II of the Non-Indigenous Aquatic Nuisance Act, which addresses zebra mussel control, again the Commission endorses any action to try and get some control measures to help the pipeline and fishery concerns. They suggested that there is a need for Canadian coordination and there are payoffs for the U.S. too. They also suggested that if you really wanted the Commission to play a significant role, that the monies in that bill would not be sufficient to do so. I think it was $100,000—for coordination.

The third point the Commission had was that right now this whole problem is an international, global shipping problem. Other places—Norway, Australia, California—have similar concerns. The U.N. has established a ballast water working group under the Marine Environment Protection Committee of its International Maritime Organization. The Commission urges that both U.S. and Canada take a leadership role there in making sure that guidelines are annexed and agreements are put in place that all nations can follow, that would help us—it being an international industry.

This group will undertake the kinds of research programs that will allow ships to consider in the future designs or retrofitting that would prevent them from enacting such an efficient transfer of organisms. There are several things that could be used.

Senator **Moynihan**. Ship design, and the way we move water around the world?

Ms. **Dochoda**. Yes. All those ballast exchanges are not always safe, there are some situations in which it is not safe. In the future, ship design could take that into account, that we would like them to exchange out in the ocean. We don't want anyone to get hurt over this.

Then fourthly—I was the only one who had an opportunity to look at the Zebra Mussel Eradication Act. I was comparing, briefly, the advantages and disadvantages of the two. I think they both have advantages.

For example, the Zebra Mussel Eradication Act may be better for the pipelines. The Non-Indigenous Aquatic Nuisance Act would be better for a general approach to all organisms, for example, ruffe, and in preventing future introduction.

Senator MOYNIHAN. That would be Senator Glenn's measure, the Nonindigenous Aquatic Nuisance Act?

Ms. DOCHODA. Yes.

Senator MOYNIHAN. Your first blush analysis here—on preventing future introductions—you say Senator Glenn's bill is better, and needs Canadian consultation? It addresses all exotics. Again, it says Senator Glenn's is the best approach.

On the mussel impact on fish, the committee bill is best, you say. The mussel impact on pipes—it is best. Then best on coordinating with Canada—all right. We can merge these bills. What do you have to say on that?

Ms. DOCHODA. Also the clams and ducks—that little clam that I gave you that is covered with mussels. The mussel does kill clams. There are a lot of other things that must not be allowed to fall through the cracks. Some of these clams are endangered, and the mussel is enough to push them over the edge.

Senator MOYNIHAN. Could I ask Mr. Martin—your bill over on the House side has 36 cosponsors.

Mr. MARTIN. And growing.

Senator MOYNIHAN. As the zebra mussel spreads—we don't have any in California yet, but it won't be long.

Mr. MARTIN. I want to thank everybody for their testimony. We look forward to future documents from the Commission.

Can I ask, as far as the zebra mussel is concerned now, as far as the intake valves and those kinds of things, where is the epicenter of the problem now? Lake Erie, Ontario, Superior? Where is it worst, Erie?

Mr. LETENDRE. There is no problem—well, I should not say it is not a problem. It is not a factor like Lake Ontario at this point. They are in Lake Ontario at this point. We believe that this summer we will be finding exactly the places that are causing problems in Lake Erie.

Senator MOYNIHAN. You mean Mr. Martin's boat is finally going to get working this year, and next year it will be all clogged up?

Mr. MARTIN. We are going to have to fix it for you. We have to get on to this zebra mussel thing.

Senator MOYNIHAN. Do you expect the zebra mussel in Lake Ontario; you will find it in Lake Ontario by August?

Mr. LETENDRE. It is in Lake Ontario now. It is in the St. Lawrence River now.

Senator MOYNIHAN. It is out here.

Mr. LETENDRE. The most recent finding in Lake Ontario was in western Lake Ontario at a power facility on the Canadian side. We have a cement plant boat that goes from Canada to the U.S. regularly, and they found them where the boat goes to the cement plant in Canada, just two weeks ago. So we know that they must be in Oswego Harbor also.

Senator **Moynihan**. There is a little bit of traffic that comes over from Canada and gets into the Oswego Canal, and goes down to Syracuse, right?

Mr. **LeTendre**. Through the barge canal. It ultimately goes to the Hudson River.

Senator **Moynihan**. To the Hudson River, which goes to the Finger Lakes——

Mr. **LeTendre**. Yes.

Senator **Moynihan**. It is all connected. We built a great water system in the first part of the century, and here it is.

Colonel Boyd, are you seeing any obstruction in existing water systems at this point, or do you anticipate any? What kind of problems do you thing this will cause and how long do you think we have before we are going to be paying for it? The Fish and Wildlife argue that it will be costing us $5 billion by the turn of the century, which is not far away. But that is just fishery consequence.

Colonel **Boyd**. Sir, I think it is difficult to say. We are already feeling the impacts and the costs of having to deal with them on water intake pipes.

Senator **Moynihan**. You are getting that now?

Colonel **Boyd**. Yes. The water companies around the Basin are spending money cleaning them out, figuring out alternative ways to continue to draw the water out. In Europe, they have frequently had to go to multiple water intake pipes where they closed some down for maintenance, then closed the next one down, opened the first one after they had cleaned it—that sort of thing. We are starting to see water companies in our basin that are having to do experimental things on their own to try to solve the problem.

Senator **Moynihan**. Is it a point that we should keep in mind that Europeans deal with this thing daily? The power plant in Berlin was closed for a month in the 1920s. So there have to be some examples of management we can look to—what do they do?

Ms. **Dochoda**. A lot of the things they have developed since the mussel was there and their plants are constructed differently. The intakes are twin, so you can close one and clean it——

Senator **Moynihan**. That's what Colonel Boyd was saying.

Ms. **Dochoda**. They can backflush, their powerplants can backflush with hot water—we can't. There is a lot of capital costs here. Our plants were never, ever designed for that kind of function.

Senator **Moynihan**. We are going to hear from the power companies this morning.

But this is a fact, that there are advanced economies who have had this infestation for centuries, and have devised ways of handling it. On the other hand, they do not have large fisheries at stake, do they? There are no large lakes, like our Great Lakes system, in Europe. And this does not live in salt water, so the North Atlantic fisheries are safe.

Mr. **LeTendre**. I was just going to say that we just don't know what this would do to a fishery at this point in time, but we do know that it will not help. In Lake Erie, there is warmer water.

It is interesting to note that our waters are tremendously cleaner than in Europe. I think that is contributing.

Senator **Moynihan**. One consolation is that the salmon are back.

Mr. **LeTendre**. The salmon are back.

Senator MOYNIHAN. The salmon are in excellent condition. Let it be noted that 20 years ago there was no such thing.

Mr. LETENDRE. In 1968, there was no fishing in Lake Ontario proper.

Senator MOYNIHAN. When we deal with something like this, let's deal with it properly. In 1968, there was no fishing in Lake Ontario proper for anything. I am a fisherman, not of any consequence, but I fish. The one thing in 1959 or 1960, I was teaching at Syracuse, going around looking for fish, and I would get up to the Tug Hill plateau, but there was no fish in those waters.

Mr. LETENDRE. In the eastern Lake Ontario and St. Lawrence River, there has always been an amount of bass fishing.

Senator MOYNIHAN. Here, but not in Oswego.

Mr. LETENDRE. From Henderson west, there was no fishing.

Senator MOYNIHAN. We did that. It is alive again, it is a beautiful thing to see the salmon and trout. So let's keep it that way, and pay attention to what we have?

Mr. MARTIN. Do you know the Altmar Fish Hatchery?

Senator MOYNIHAN. No.

Mr. MARTIN. The Altmar Fish Hatchery is fascinating. When that was being constructed, there were people saying that they were looking for budget support. Let me tell you something—that is something that would make money all across the State.

Mr. LETTENDRE. That's the backbone of our whole salmon trout program, that one hatchery.

Mr. MARTIN. You cannot fall into the water without falling into another fisherman down there. It's incredible.

Could I ask you one question? I am not an expert on boats, much less ships. But as far as the exchange of ballast, how big a deal is that? How much of an inconvenience is it? Why won't the shippers comply voluntarily?

Ms. DOCHODA. Eighty-three percent of them are complying voluntarily. The shipping association that represents these ships is supporting us and getting the word out. They have asked their members that have agreed to it. But 83 percent of anybody obeying any request—a speed law or something—that's pretty good.

The problem is that it is not good enough. There actually have been recalcitrants where the Canadian Coast Guard called Fisheries and Oceans in Canada and asked what regulations there are that they can throw at these people. They will not exchange their ballast.

Mr. MARTIN. My question is, is it a big deal? It is done routinely, isn't it?

Ms. DOCHODA. No. It is not a big deal. They do it routinely for their own purposes. It takes about eight hours. It is like eight hours of running a pump. So it really is not that expensive.

Senator MOYNIHAN. There is a cost. You have to take the water aboard and discharge it. There may be some ships that cannot readily handle this in the high sea.

Ms. DOCHODA. A container ship with a high center of gravity might have trouble. And that is why the Canadians have offered these ships an option. There are backup options. The ones they have offered are that if the ships cannot exchange their ballast in the high seas, they will let them do it in the Gulf.

Actually, there were 12 ships that exchanged in the Gulf. The Canadians accepted the risk of having something introduced there to protect up here. But they are still—giving them that option—there were still 176 ships that did not exchange.

Senator MOYNIHAN. What we will do is paint big yellow signs on them that say "This ship is in non-compliance."

Ms. DOCHODA. Greenpeace——

Senator MOYNIHAN. They do fine them, don't they?

Ms. DOCHODA. No, it is totally voluntary.

Senator MOYNIHAN. Totally voluntary.

We thank you very much. This has been very helpful. We now know where to go for information. Colonel Boyd, the Corps is taking on another job. We need to start thinking this way and getting them in Washington informed. I hear you saying that they will have this problem in California and in the Mississippi. We may as well get onto it.

You don't like doing this with chemicals. You want to find some natural mode, is that it?

Mr. LETTENDRE. Not 100 percent through chemicals. We don't want a quick fix with a chemical that is going to end up giving us a problem. If the proper research is done on the chemical——

Senator MOYNIHAN. That's how we did the lamprey, right?

Mr. LETTENDRE. There was a very intensive laboratory study to determine a chemical that would kill young sea lampreys (ammocetes) in streams.

Senator MOYNIHAN. Who found that cycle of the eggs in the mud?

Ms. DOCHODA. Vernon Applegate, with the Fish and Wildlife Service.

Senator MOYNIHAN. Did anybody give that man a prize?

Ms. DOCHODA. I don't think so. We thanked him very dearly.

Senator MOYNIHAN. There is the symbolic factor. Vernon Applegate?

Ms. DOCHODA. Yes, sir.

Senator MOYNIHAN. It is about as elegant a thing as I have ever seen. They found that the life cycle of that lamprey—at a point where they are down in the mud—you can get something down in that mud and the next thing you know, you have Lake Erie back. There must be something we can do for Vernon Applegate of the Fish and Wildlife Service.

Ms. DOCHODA. It was at Hammond Bay Biological station of the Lacrosse Laboratory.

Senator MOYNIHAN. Lacrosse Laboratory—is that in Wisconsin?

Thank you very much. Thank you all very much. We appreciate all of you coming over. We are glad you brought your family with you.

Now we are going to hear from two people directly involved, Mr. Charles O'Neill of the New York Sea Grant Extension program, and Mr. John Malinchock, who is the Director of the Environmental Services for the New York State Power Authority.

We welcome both of you gentlemen, and we will start with you, Mr. O'Neill.

Would you tell us what the New York Sea Grant Extension Program is?

Mr. O'NEILL. It is a university-based coastal research and education program of the State University of New York and Cornell University. It receives approximately two-thirds of its funding from the Federal Government through the National Oceanographic and Atmospheric Administration, and the remaining funding through the State of New York.

Senator MOYNIHAN. We have and will place in the record, the Sea Grant Cooperative Extension New York State Cornell University paper on Dreissena polymorpha, an unwelcome new Great Lakes invader, by Charles R. O'Neill, whom I have reason to believe is here before the committee this morning. (See p. 47.)

STATEMENT OF CHARLES R. O'NEILL, JR., REGIONAL EXTENSION SPECIALIST, N.Y. SEA GRANT EXTENSION PROGRAM

Mr. O'NEILL. The Dreissena is spreading very rapidly through the Great Lakes. Since its initial discovery in Lake St. Clair back in June, 1988, the mussel spread into the western basin of Lake Erie by the next month. By the end of 1989, it was being found in industrial water treatment systems and on beaches throughout Lake Erie, all the way to Buffalo, New York. In just that one year, it spread that far.

The mussels were first reported in Lake Ontario at Port Weller, Ontario, west of the downstream end of the Welland Canal in November, 1989. It was then found in water intakes throughout the Niagara River by January of this year.

During routine maintenance on locks on the St. Lawrence Seaway this winter, mussels were found in large numbers in the Snell Lock and in lesser numbers but throughout the Eisenhower Lock in Massena. In April of 1990, zebra mussels, some of them up to an inch and a quarter in length, were found on a cement plant boat pier in Kingston, Ontario, and at the same time showed up at the New York Power Authority's Niagara River Power Project.

We have them therefore at both ends of Lake Ontario, and I would not be surprised if they had been dropped off at locations along the middle of it as well.

Biologists are afraid that this spread is going to be out of the Great Lakes into other water basins and throughout all the Great Lakes. Biologically, the critters can be spread by fish, water fowl, turtles—anything they can attach to or hitchhike on. They can also be spread by a lot of human-mediated dispersal methods. I think these are the ones that we are going to see will be the most important.

Within the Great Lakes system, we will intra- and inter-lake shipping transporting mussel juveniles and larva in bilge, in ballast water, in cooling water of boats and ships. We will also see a certain amount of them transported through agricultural irrigation projects that are using the Great Lakes as their water sources, and through canals.

The discovery of mussels in Green Bay and Sturgeon Bay on Lake Michigan is believed to be evidence of just this kind of transfer by ships.

A major dispersal vector will be interbasin transport—mussels actually leaving the Great Lakes. That is expected to happen to get the critters into the Finger Lakes, the Mohawk River, the Hudson River, and other major water systems in New York State via the Erie Canal, which is taking in water at Buffalo, water that as soon as the water temperature hits 50 degrees——

Senator MOYNIHAN. Water at Black Rock.

Mr. O'NEILL. Right. At 50 degrees we will see larva in that end of Lake Erie. At that point, I believe we will also see larva starting to show up in Lake Ontario—definitely in the Erie Canal.

The inadvertent spread of the mussel, however, from infested waters to clean waters by humans is going to be very significant, I am afraid. We expect to see one of the large transports be recreational boating, anglers, sailors, people who are traveling from waterway to waterway in pursuit of the biggest fish or the best sailing conditions or the best water skiing conditions.

Every time a boat is pulled out of Dunkirk Harbor in Lake Erie—those boats are dripping water, they have bilge in them, water in their live wells, there may be infested water in people's bait buckets, in the cooling systems of the engines, in the channels and frames of the trailers that the boat is on. If those boats are put into another lake like Canandagua Lake, Seneca Lake, Lake Chataqua, they could be moving those mussels into those lakes. Lake Chataqua would put those mussels at the headwaters of the Allegheny River system.

Senator MOYNIHAN. At the Mississippi River system, a matter of local patriotism.

Mr. O'NEILL. Right. Once it hits Chicago.

Anyplace on a boat that is wet when it gets put on a trailer could be traveling mussels. If they are larvae and don't get into direct sunlight, they can survive several days. If by chance a juvenile or adult shelled mussel is hiding out somewhere on that boat in the shade, they can live up to a week out of water. So it is not a matter of just drying your boat off a little bit.

Mr. MARTIN. May I say something? Bill Safe, here in Watertown, has a show on fresh water fishing. I had members from Arkansas, Texas, and other places ask to see this show. When you are driving up route 81 in the summer, you see license plates on cars from Texas, Oklahoma, and they have a boat and they are hauling it all the way up here to fish.

So it's everybody's problem. Not just along the lakes.

Senator MOYNIHAN. I am learning this. This is the one thing I had not gotten through my head at all, at how fast this is going to happen. We are not going to stop this.

Mr. O'NEILL. Some biologists expect that the zebra mussel will be throughout the surface waters of the northeastern U.S. within the next 20 years.

Senator MOYNIHAN. Within the next 20 years?

Mr. O'NEILL. Yes.

What makes them a problem beyond the fisheries impact is the way in which the mussels attach to nearly any hard substrate, not just stone, but steel, concrete, wood, plastic and glass—all those wonderful things that are used in water treatment plants and industrial plants and power plants. They have the potential to affect navigation by sinking the buoys from the sheer weight of the attachments of the mussels, to plug up the cooling water systems within a ship, overheating the engine, overheating the engine on a recreational boat. We are hearing of this happening on Lake Erie already.

When we look at what that impact may mean in dollars and sense for shipping, it appears according to the U.S. Fish and Wildlife Service's worst case scenario that over the next 10 years the zebra mussel may have approximately a $60 million impact on the merchant marine fleet, and an additional $5 million impact on smaller pleasure vessels.

The mussels are also fouling those water intakes at electric power generating and industrial facilities and at public water supply filtration facilities. Today they are throughout Lake Erie and the Niagara River, and are expected this year in Lake Ontario, and the St. Lawrence Valley.

What is happening is that the continuous flow of water through those intake structures provides a continuous source of food for the mussels inside an intake pipe, it can be pig heaven for the zebra mussel. Those structures therefore become preferred, ideal habitat. You have a piece of pipe up in front of you showing what can happen to small diameter tubing. We have seen samples of four-foot diameter pipes that are occluded almost as badly as that small pipe.

One upper Great Lakes utility, I believe it was Detroit Edison in Monroe, Michigan, reported 750,000—three quarters of a million mussels—per square meter on its intake canal. They were able to hydroblast that off with hard-hat divers going in. There are a lot of places that if it is a two-foot or three-foot diameter pipe, we are going to be facing a much different situation.

Senator MOYNIHAN. Would you say that again? What was the utility?

Mr. O'NEILL. Detroit Edison in Monroe, Michigan. It is one of the largest coal-fired plants in the U.S. They had three quarters of a million mussels per square meter. Very small mussels, but very thick layers of them in their intake canal. That was last fall.

Senator MOYNIHAN. Is that canal where the top is open?

Mr. O'NEILL. Yes.

Senator MOYNIHAN. So it is easy to get into—it is not piped?

Mr. O'NEILL. They could get into it. It is not like the cooling tunnels for the Nine Mile One and two nuclear power plants in Oswego.

Senator MOYNIHAN. Downriver.

Mr. O'NEILL. Or let's say the Rochester Monroe County Water Authority—they have a six-foot diameter pipe 8,000 feet long 50 feet under water into Lake Ontario. If that pipe were to have that kind of density, it would be much more difficult for them to clean out.

Not only is it plugging up the canal and reducing the amount of water, but the larvae can get throughout a plant. They can get into the heat exchangers, they can get into the cooling water, into the fire-fighting service lines. The Niagara Mohawk Power Plant in Dunkirk, New York has mussels virtually throughout the plant wherever water from Lake Erie circulates.

Senator MOYNIHAN. Those are big machines, those things. And it gets all through the machines?

Mr. O'NEILL. It can get throughout a system. Anyplace that is not chlorinated or heated to 100 degrees or more. If a place really needs to keep them out, they can get into all kinds of filtration equipment, but that is not practical when you are pumping millions of gallons a day to cool a power plant.

It is expected that over the next 10 years, powerplants may be looking at $800 million for redesign and $60 million for annual maintenance and treatment for zebra mussels for nuclear and fossil fuel plants throughout the Great Lakes. Additional public and private water supply infrastructure throughout the Great Lakes faces the same type of situation, and it has been projected that over the next 10 years, about nine major cities, 11 smaller cities and 50 small town water treatment plants will also have to be retro-fitted to cope with the zebra mussel and face annual maintenance.

In addition, our industries—big industries that are using lake water—for example, the Eastman Kodak company in the Rochester area, is purifying as much water in their own system as the entire county is in theirs.

Senator MOYNIHAN. Is that right?

Mr. O'NEILL. That system functions to serve most of Kodak Park, and it is operating at peak efficiency. If the mussels were to plug up their intake pipe, you would be looking at some substantial down time, and a very large possible economic loss.

Senator MOYNIHAN. Kodak takes their water out of the lake as does the city.

Mr. O'NEILL. Right. They have their own water system.

Senator MOYNIHAN. They are pumping it, aren't they?

Mr. O'NEILL. They are pumping it from the lake, treating it at the lake shore, then pumping it several miles to the Kodak Park industrial facility.

Senator MOYNIHAN. I guess I didn't realize—the world is full things I don't know—but I didn't realize that the City of Rochester has to pump its water?

Mr. O'NEILL. Rochester City is pumping it inland from two small Finger Lakes, Canadice Lake and Hemlock Lake. By the way, they allow fishing with boats, and they are concerned about it hitchhiking in boats to their lakes. But the Monroe County Water Authority, which covers all of Monroe County, also supplies about half the water for the City of Rochester. That is all coming in through that 8,000 foot pipe into Lake Ontario.

Senator MOYNIHAN. New York City is blessed with some great engineering. How many cities do we have that have to bring their water in, expend energy to get their water?

Mr. O'NEILL. On the Great Lakes, most of the small and large cities around the lakes are actively pumping from Lake Ontario, Lake Erie, the other Great Lakes. That is Canadian facilities as well as American.

Senator MOYNIHAN. That's expensive water, then.

Mr. O'NEILL. You mention the City of New York. The Neversink River and the Delaware River reservoir system, being fresh water, are also threatened by the zebra mussel, should it get transported by boat to those areas.

Senator **Moynihan**. You would never get into that system again. It is miles around and solid rock. You would never be able to fill it again. At the turn of the century, they built that great zee into the Hudson. That's what built Bronx and Brooklyn. The entire city is gravity fed. Without any expenditure of energy of any kind, the water goes to the fifth floor. A lot of Irishmen worked on that—the Irishmen built the Croatan Reservoir. By that time the Irishmen were the assemblymen, and tney hired carriers.

Mr. **O'Neill**. The impact on the public water supply infrastructure is expected to be around $600 million over the next 10 years, and to the industries, probably $500 million over the next 10 years.

As you heard before, the control measures we are looking at today, physically scraping mussels from pipes, depriving them of oxygen by shutting down an entire pipeline, flushing the system with hot water—that's a minimum of 100 degree water, it's tough to cool a power plant at 100 degrees—chlorinating, or ozonating, or using potassium permanganate, or mulluscicides. These are all band-aid approaches.

So far, none of these looks to be a silver bullet for cleaning out the zebra mussel. Over the next several years, when we face the initial explosion of the population of the zebra mussels, I think these and perhaps some other measures will be cobbled together to come up with a quick fix to keep the turbines spinning, to keep the water flowing at the tap until better, or best available technology methods come up.

We are facing a unique situation. The Europeans have been dealing with them for 150 to 175 years. Things have just evolved as they went along. We are in a position to turn a real high-tech, scientific community loose on solving the problem in a crisis atmosphere. I think we will see a lot of good research going on over the next few years, and I believe that what is most needed right now, aside from making sure these things don't get transported any more than they have to, is going to be a combination of monitoring public information and education.

To slow down the transport and develop controls—I go into what types of research in the paper which I have given your staff today. It is going to be a long, hard road. The next few years are going to be an exciting few years to make sure that we see that infrastructure continuing to function as it does today, and as we develop the ways to keep it functioning after these next several years.

Thank you.

Senator **Moynihan**. Thank you, that's very explicit, very good.

I can see every water system across the State here in serious trouble. If this ever got into the Delaware water system, making its way down from New York City, going north from there—you can't live without water. We can live without love and all sorts of things, but we can't live without water. That's one thing we have that Southern California does not. We may end up selling it to them. But we can't sell it if it has the zebra mussel in it.

Mr. **O'Neill**. As far as informing the public about the zebra mussel, I might mention, in addition, that New York Sea Grant has just received a $100,000 grant from the Empire State Electric

Energy Research Corporation, which is made up of most of the electric generating companies in the State, to establish a New York State Zebra Mussel Information Clearinghouse.

We will have staff on board and be operating, hopefully, by the second or third week of June. It will be located at our regional office, at State University College in Brockport. It will be collecting as much information as we can get on the mussel from wherever we can get it—here, Canada, Europe. We have contacts in The Netherlands and West Germany. It will be disseminating that information to all the user groups that need the information in a timely fashion and in a form that they can use, whether that is John Q. Citizen who wants to keep his motorboat from overheating, or the City of New York who wants to figure out how to keep it out of Cannonsville Reservoir. That information will be available.

Senator MOYNIHAN. That's good to hear.

Mr. MARTIN. Thank you. This particular piece of information is fascinating, it is a primer and a half. We ought to circulate this. It is good stuff, and I thank you very much for it.

Senator MOYNIHAN. It is good stuff. This is taking on a new dimension. New York City should act like it has an emergency on its hands. If this gets into the Papacton Reservoir, for example, those are tunnels blasted through the rock, and inaccessible.

Mr. O'NEILL. There are ways a water treatment facility can treat a tunnel or pipe to keep it clean, assuming it is clean to begin with. That would be injecting a strong oxidizing agent at the intake end of that intake pipe. Whether that would be chlorine, ozone, potassium permanganate, hydrogen peroxide, it doesn't matter. They are all effective against zebra mussels. Since those are chemicals that water treatment plants typically use, perhaps at a different location, they are familiar with them, their clientele is familiar with chlorine in the water at the tap.

It will be expensive, but they can address the issue fairly easily. Powerplants face a slightly different problem. They are using in most cases far more water, and are discharging that water back into the environment. Anything they put in to keep the mussels under control in a power plant may very well have to be removed or detoxified at the discharge end, which makes it a much more present concern that they come up with new high-tech approaches. I believe they are working on this. We have been in contact with them. The New York Power Authority is very active.

Senator MOYNIHAN. Why don't we hear then from Mr. Malinchock? Thank you very much.

Mr. MARTIN. Thank you for your interest, and for coming up. John, I have read your testimony. We are looking for good news, you have terrible news. We have been talking good news for the last two years. We had a shortage of water for recreational boating the last two years. The Corps of Engineers, the Power Authority, the Ontario Hydro, Hydro Quebec, St. Lawrence Seaway Development on both Sides, working together, and with everybody giving a little, we resolved that problem. I want to thank you, and I thank Chairman Flynn every time I see him. This year, God weighed in heavily with water and we are in good shape. But that doesn't mean that next year we will not have to get together again.

Thank you, and I am sorry, but I have to leave.

Senator **Moynihan**. Thank you, sir.

Mr. Malinchock.

STATEMENT OF JOHN C. MALINCHOCK, DIRECTOR OF ENVIRONMENTAL SERVICES, N.Y. STATE POWER AUTHORITY

Mr. **Malinchock**. My name is John Malinchock. I would like to express my appreciation for your invitation to appear today before the subcommittee to talk about an issue which is of critical issue to the Power Authority and its customers.

As you know, the New York Power Authority is the Nation's largest Federal public power organization, and provides about a third of the electricity used in New York State. We are a non-profit public corporation which finances, builds and operates electrical generating and transmission facilities for the purposes specified in our legislative charter.

We own and operate two major hydroelectric power projects which are powered by the waters of the Great Lakes Basin. The St. Lawrence-Franklin Delano Roosevelt Power Project at Massena, New York, was licensed by the Federal Power Commission in July of 1953. The net rated output of the St. Lawrence-FDR project is 800,000 kilowatts, and the average annual generation is approximately seven billion kilowatt hours.

The Power Authority's other major hydro plant, the Niagara Power Project, is located on the Niagara River, approximately four and a half miles below the Falls. This project operates using flows diverted from the Niagara River at a point two and a half miles above the Falls.

Power from these two facilities is sold to 47 municipal electric systems and four rural cooperatives in New York State, and to three upstate utilities for the benefit of their rural and residential customers. Pursuant to Federal law and State policy, the projects also serve specified industries that directly employ more than 40,000 workers and are the economic backbone of western and northern New York.

Each year, these projects provide savings to electricity consumers and other economic benefits which exceed their combined construction cost of over $1 billion. In addition to their enormous economic benefits, these projects have significant environmental and strategic values. The Niagara and St. Lawrence-FDR projects are directly responsible for the energy equivalent of about 35 million barrels of oil per year.

We also operate two nuclear power plants which are dependent on water from the Great Lakes and the Hudson River.

The J.A. FitzPatrick nuclear plant is located on Lake Ontario in Oswego, New York. Power from the FitzPatrick plant is sold to utilities throughout the State, and half of its output is dedicated to fostering economic development.

Indian Point No. 3, located on the Hudson River, serves all the electric needs of the public entities in Westchester and New York City including the Metropolitan Transportation Authority, the New York City Housing Authority, and the city and county school districts.

It is apparent that the power produced by these facilities is vital to the economic health and well being of New York State. The zebra mussel, by interfering with the maximum effective operation of these plants, could jeopardize the reliable economic supply of power to a wide variety of critical components of our society.

At worst, power production from these facilities could only be replaced by more expensive and less environmentally compatible energy resources.

Since its introduction into Lake St. Clair in 1986, the zebra mussel has spread very rapidly to infest the Great Lakes system and has recently been observed in the St. Lawrence River near Massena. Left unchecked, the zebra mussel has the potential to infest the waters of much of the continental United States.

The zebra mussel is a serious biofouling pest in Europe that appears to have found its own niche in North American waters. Dreissena has the potential to foul municipal and industrial water intake facilities, disrupt the ecosystem, interfere with sport and commercial fishers, navigation, recreational boating and beach use. In the 200 years that Europe has been dealing with this creature, methods have evolved for society to cope with its presence, such as dual intake structures to permit maintenance.

Dreissena's sudden appearance in North American waters, and its aggressive reproductive rates require the users of the infested waters to respond to the serious threat that it poses. We lack the luxury of time to adapt to its presence. As the operator of major electric generating facilities utilizing Great Lakes waters and several other facilities that will be affected in the near future as it spreads beyond the Great Lakes, the New York Power Authority welcomes the interest of the subcommittee in addressing the zebra mussel problem. Virtually 100 percent of our generation comes from thermal and hydro facilities on inland waterways.

The utility industry has moved to cope with the Dreissena problem at several levels. At the national level, the Electric Power Research Institute has formed a zebra mussel advisory group to disseminate information, coordinate monitoring and control technologies, and fund appropriate research projects.

In New York State, the Empire State Electric Energy Research Corporation, which constitutes the State's even investor-owned utilities and the Power Authority recently executed an agreement with the New York Sea Grant Extension for a Zebra Mussel Information Clearinghouse.

Senator MOYNIHAN. That's the one at Brockport?

Mr. MALINCHOCK. Each user of Great Lake waters must face the eventuality of being affected by Dreissena. At our Niagara plant, the plant nearest the point of the initial infestation by the zebra mussel, a monitoring program has been initiated, and a chlorine injection system has been designed. The first mussels were encountered within the plant last April.

I would like to digress from my statement at this time. I have some photos here that were taken as recently as yesterday, and some that go back to approximately six months ago. I am presenting these as an example of what I like to call a before and a midway point. The photos you have there show our trash racks at the Lewiston Pump Generating Plant. The Pump Generating Plant basically pumps water from the bay into our reservoir. It prevents the debris and flotsam from entering the pump. We install trash racks, and they are rather large, as you can see.

There are eight racks in a slot. The openings on the racks are approximately a foot by six inches. Yesterday, during maintenance, we discovered a couple of mussels. By a couple I mean approximately one or two every three to four square feet. That does not seem like a lot at this time, but if you consider the fact that last October that was the concentration that was observed at Snell, then you look at the photos we have of the Snell lock approximately six months later, you can see the tremendous impact that one or two mussels per several square feet can have on a facility.

Senator Moynihan. This is Snell Lock?

Mr. Malinchock. Yes. That's up just outside of St. Lawrence, Massena, New York.

Senator Moynihan. Oh, I see. This is the St. Lawrence-FDR. May we have these?

Mr. Malinchock. Yes, those two sets are yours.

Senator Moynihan. Thank you.

Mr. Malinchock. The monitoring program which has been instituted at Niagara will assess both the actual and potential impact of the zebra mussels on our facility, as well as the effectiveness of our treatment system. We have additionally instituted a monitoring program at our St. Lawrence project, and also at our nuclear facilities.

Beginning Monday, May 21, water column sampling using a modified Wisconsin Plankton net will be conducted——

Senator Moynihan. That's a technology, plankton net? It will catch things about the size of the plankton?

Mr. Malinchock. Plankton size is what we are basically doing. We are going to attempt to assess the concentration of the villagers within the water column.

The sampling will allow us to determine the concentration of the mussel larvae in the water column. Zebra mussel collection plates have been established in Lewiston Reservoir, the Moses Screenwell intakes, and the Authority's Adam Slip, located approximately ¼-mile upstream of the Falls themselves.

The stations have been established to monitor settling and infestation rates and eventually the stations will be used to monitor the growth rate of the mussel.

The Authority has requested approval from the New York State Department of Environmental Conservation to modify the Niagara Project's SPDES permit to allow for chlorination of the service water system at both the Moses and Lewiston projects.

At this time, we are utilizing the technology that has been available to us to install this system based upon the research we have done into the effectiveness of chlorine. We are not at this moment pursuing the use of molluscicides to control the mussel. Our theory is that we want to prevent the mussel from entering our plant so that we can control it before it has a significant impact on the cooling system.

The service water lines at these projects supply the cooling water requirements to various critical systems at each generating station, and are vital to normal plant operations.

As shown in the attachment I have given you, the Moses Project service water chlorination system will consist of a 6,000 gallon storage tank that will contain a 15 percent sodium hypochlorite solution, secondary containment, two metering pumps, associated vales and piping, and an eight foot high security fence initially. We have a similar system with a 3,000 gallon storage tank going in at the Lewiston Pump plant.

The initial chlorination solution feedrate for the Moses project will range from 39 to 78 gallons per hour. The initial feedrate at the Lewiston project will be between 12.5 to 25 gallons per hour. At each project, these feedrates are expected to maintain an in-plant downstream total residual within the plant range in concentration of 0.2 to 0.5 parts per million. It should be understood that it is not a discharge, it is a residual that will be maintained within the plant.

Once the necessary feedrates to maintain the required levels have been achieved, and have definitely been determined, the solution will then be injected two hours per day, seven days per week. Based on available water data, the Authority believes that chlorination will be necessary from May 15 through October 15 of each year for as long as the zebra mussel problem persists.

Your bill calling for research and technology development for control of the zebra mussel in and around public infrastructure is a welcome development. It will be an important tool in coping with the impacts from Dreissena. The information gained from this and other research efforts, such as those by the utility industry, will serve the public relying on Great Lakes waters today, and the rest of North American in the future.

I might add that we are working very closely with the Department of Environmental Conservation on this subject. We have been working with Ontario Hydro. We are attempting to set up by working with local water treatment plants in the Niagara area that we would like to call on something that Mr. O'Neill has referred to as an early warning system, so we can detect the onslaught of the villagers, so that we will know best when to turn on our facilities, so we can limit the amount of chlorine we are injecting into our cooling system, and that we can alert others in a coordinated, cooperative effort to tackle this problem.

We will only be treating something in the neighborhood of 35 million to 40 million gallons of water each day. That is but a mere drop in the bucket compared to the water that passes through our units at the Niagara project. The problem that I brought to you today, the fouling of the trash racks, is a problem that we had not really totally expected. We had expected some impact, but we had not expected to see the Dreissena adhering to the rack based on our velocity calculations.

There are many areas within the plant——

Senator **Moynihan**. You mean at the rate at which the water goes through there, you didn't expect any to catch hold?

Mr. **Malinchock**. Yes, that's right. There are additional problems. We do anticipate having to manually scrape and airjet other areas within the facility. We could go on and on. It is a serious problem. It may very well be the environmental problem of the 1990s.

I would like to thank you for your time.

Senator MOYNIHAN. It may very well be the environmental problem of the 1990s. This is taking on a new dimension for me. I came here thinking about fisheries, and suddenly I am thinking about water and power systems, and much more. Will you have to be careful with chlorine?

Mr. MALINCHOCK. We do not like to inject anything needlessly or contribute in any manner or form to what is naturally occurring within the natural ecosystem. We do have to be careful on the amount of chlorine that you are discharging. There are specific discharge limits.

Senator MOYNIHAN. It will end up out here?

Mr. MALINCHOCK. Basically it will end up out there. Our discharge figures will be basically in the non-detectible range, which will put them somewhere in the—depending on the specific discharge—literally render them non-detectible based on today's monitoring technology.

I must point out, and I think it is a significant point, that we did not bring out—we are going with a monitoring system that has double backup systems on it, that will tell us every minute what our concentration from minute to minute is, and what our concentration within the plant is prior to its eventually being discharged into the Niagara River.

Maybe Mr. O'Neill would like to refer to some of the problems that can be encountered in the drinking water plants. Drinking water arriving at your home, for example, typically will have a chlorine residual of 0.2 to 0.3 parts per million. That is the same residual we are going to maintain in-house, but it is basically a residual that will not be there upon discharge. We are probably looking at a less than .0001 part per billion, if it is existent.

Senator MOYNIHAN. Well, indeed. There might just be a silver bullet around, but there is none now. Is it going to move everywhere? In 20 years, did you say, Mr. O'Neill, it will be in the surface water throughout the country? There is no way to stop that, with boats coming up here from Texas, and so on.

Mr. O'NEILL. Quarantines tend not to work. A very good example of that is the gypsy moth. If you can control 90 percent or 95 percent of the boats and miss 5 percent of the boats and bait buckets, you can still transport the thing around.

Senator MOYNIHAN. Yes. I think I know enough epidemiology to know that we can't quarantine something like this. Then we learn to live with it. We have learned to live with the gypsy moth pretty well. But that's a little different from something that impose enormous costs on the elemental infrastructure, water and power. That's where you start—with water first.

Mr. MALINCHOCK. Last week, we hosted an EPRI conference on the zebra mussel at the Niagara project, and without getting into specifics as to what utility industries were there—they were there from across the entire United States. One utility industry reportedly made the statement that there is the potential for generating 20 percent more of the problem at their facilities this summer. The problem is here and very strong.

Senator **Moynihan**. One of your people at Niagara said that there is a public utility which has a unit where they think they may lose 20 percent of their generating capacity this summer?

Mr. **Malinchock**. Yes, sir. So it is significant.

Mr. **O'Neill**. There was a public water supply treatment plant in the western basin of Lake Erie which, back during late December or early January, had a frazzle ice problem on their intake. Normally, they could have pumped through the ice at reduced efficiency, but they would have been——

Senator **Moynihan**. What is frazzle ice?

Mr. **O'Neill**. Slushy ice that starts to form around the face of an intake. What happened though with the amount of zebra mussels in their intake pipe and the reduction of efficiency due to those, the plant lost draft, and took up to an hour to reestablish pumping ability through that pipeline. It is for a major metropolitan area.

Senator **Moynihan**. I am spoiled, as a New Yorker, I am used to the New York City supply. The water supply in New York City was, for half a century, the most despised institution. When Tammany hacks, as they were called, no longer hacked, they were sent to the water supply where they embarrassed the city for the remainder of their years. It has had its share of problems.

Those people put into place the most extraordinary water system in the world. They built the first true aqueduct since the Alexandrine Aqueduct in fourth century Rome. It was an engineering genius.

The department is all underground, you can't see it. It is all gravity fed. There is not an ounce of energy that goes into it. It serves those four story buildings in Manhattan, and the Bronx. For the water to get that high up without expending energy——

I didn't know we pumped. Rochester is a very successful city, but if they have to pump it, and it has this problem——

Mr. **Malinchock**. Yes, fouling those pumps. I had the opportunity in February to visit a utility, and while I was there on another subject matter, they opened up a valve that had been fouled. Literally, the mussel does not crawl out, but it reminded me of kicking over an anthill. They disassembled a six-inch valve, and pulled the valve stem, and it was literally obscured with live zebra mussels.

Senator **Moynihan**. There's a great movie in there. That's the first cheerful thought I have had all morning.

I want to thank all of you, and I want to thank our most able reporter, who was able to visit his sister in Syracuse while he was there.

The hearing is closed, the record will remain open for 30 days if anyone wants to make amendments, or send anything else in. I think we will hold a hearing in Washington on the bill proper, and on Mr. Glenn's bill. Obviously, we have our work to do. Your statements are the environmental issues of the 1990s—they are graphic. There is always something.

Again, thank you all very much.

[Whereupon, at 12:10 p.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Statements submitted for the record follow:]

STATEMENT OF MARG DOCHODA

GREAT LAKES FISHERY COMMISSION STATEMENT ON PREVENTING AND MANAGING BALLAST INTRODUCTIONS

Alexandria Bay, New York
19 May 1990

1. Preventing future ballast introductions is most crucial (Title 1, S 2244)

The Great Lakes Fishery Commission, after consultation with the directors of Great Lakes fishery agencies, endorsed Title 1 of the Non-indigenous Aquatic Nuisance Act of 1990 (S 2244, HR 4214). Title 1 requires ballast water exchange or treatment before discharge into U.S. waters.

Biological pollution (exotic introductions) is in the long term more costly than oil or chemical spills. Established populations of exotic organisms maintain themselves and expand often far beyond the original point of introduction. Given the costs associated with introductions such as the sea lamprey and zebra mussel, this is surely a case where an ounce of prevention is worth a pound of cure. At stake are all the human uses we invest in our waters, from drinking water to recreation.

Scientists have documented some 100 exotic plants, animals, and (fish) pathogens in the Great Lakes, with as many as a third attributable to ballast water discharge. Ballast water appears to have become the predominant source of unplanned introductions in the last 20 years - possibly due to improving water quality in the Great Lakes and foreign ports. Without ballast exchange or treatment the Great Lakes can expect to continue to be the recipient of unexpected harmful introductions with Russian roulette unpredictability.

Title 1 of the Nonindigenous Nuisance Act would address two concerns of the Commission, at least on the U.S. side. The first of these is that ballast exchange must be observed by **all** ocean-going vessels entering the Seaway. In 1989, 83% of ships reported observing the Canadian Ballast Control Guidelines. Although the Commission appreciates the efforts of cooperating ships, the fact remains that 17%, or ~170 ships each discharged as much as 1.25 million gallons of ballast water into the Great Lakes. (For comparison, a typical swimming pool holds 30,000 gallons.) A single ship is capable of effecting numerous introductions under favorable conditions.

The second concern addressed by Title 1 is the need to control ballast discharge in waters connected to the Great Lakes, such as the Hudson and Mississippi Rivers. We know that being downstream is no barrier to exotics such as the zebra mussel and the spiny water flea, and even the ruffe.

In endorsing Title 1 the Commission added that the American Government should consult and coordinate with Canada re implementation of needed measures. For example, ships calling at lower St. Lawrence River ports such as Montreal and Quebec

City are not requested to exchange or treat ballast under either the Canadian Guidelines nor (of course) under the proposed U.S. legislation. Also, enforcement of Title 1 would more easily be achieved at the St. Lawrence River and Welland Canal locks, which lay on the Canadian side. It is also important that both countries provide their respective Coast Guards and any other responsible agencies with sufficient resources to monitor and enforce ballast exchange or treatment as necessary.

2. Zebra mussel management (Title 2, S 2244)

The Great Lakes Fishery Commission also endorsed Title 2 of the Non-indigenous Aquatic Nuisance Act of 1990 noting, however, that in order for the Commission to play a significant role in management of the zebra mussel, the United States should consult with Canada re the GLFC's role. The Commission, after all, reports to both Governments, and both Governments will have to develop strategies for minimizing the impact of the zebra mussel. The $100,000 authorized by the bill would be inadequate for the Commission to "advise, coordinate, and provide secretarial services on matters related to Great Lakes fisheries, environmental concerns, and interactions with the Government of Canada; and provide technical services for any technical committee established by the National Cooperative Action Group to address (these) matters ...".

3. U.S. leadership in UN working group

A long term strategy to prevent introductions has a better probability of being successful if it includes a global element. Such an opportunity for global coordination and cooperation will open in November 1990 when the Marine Environment Protection Committee of the UN's International Maritime Organization will establish a working group on ship-caused introductions. The United States and Canada should take advantage of this opportunity to protect their waters by ensuring that comprehensive discussion papers are prepared in advance, and that all necessary expertise, including biologists, oceanographers, naval architects, and water treatment specialists are made available to the working group. The Commission asks that the Governments of the United States and Canada provide leadership to make certain that the working group proposes an appropriate annex to MARLPOL (1973 Act to Prevent Pollution from Ships, with 1978 protocol) or a model program for implementation by concerned nations. The working group should also lay out a research and development program to answer technical questions with global application, eg. effectiveness and feasibility of preventive strategies including ship design or retrofit to prevent organism transfer.

4. Analysis of protection afforded Great Lakes ecosystem by Senator Moynihan's Zebra Mussel Eradication, Reduction and Obviation Act of 1990 vs Senator Glenn's Non-indigenous Aquatic Nuisance Act of 1990 (S 2244, HR 4214)

The Commission believes that the Government action which will prove most important to the Great Lakes is to prevent introduction of additional exotic organisms with discharge of ballast water. Therefore at its May 1990 meeting the Commission endorsed Title I of the Glenn bill, urging consultation and coordination with Canada. (Moynihan bill has no prevention language, whereas Glenn's is strong on prevention.)

At its May 1990 meeting the GLFC endorsed Title II of the Glenn bill, adding that in order for the Commission to play a coordinating role of any significance, the Canadian Government should be consulted. Also, the $100,000 provided the GLFC by the Glenn bill was judged inadequate to support a significant GLFC role. (The Moynihan bill, which was not available for GLFC review in May, specifies a mechanism for Canadian consultation and is said to provide funds adequate for meaningful GLFC activity in addressing the zebra mussel.)

In efforts to manage and control new exotics such as zebra mussel it is important to recognize that there is a continuing need to address yesterday's invaders and introductions (such as sea lamprey and alewife). This is the reason for the Commission's emphasis on prevention, and for recent requests for additional funds for sea lamprey control and research. (Neither Glenn nor Moynihan addresses "yesterday's exotics", such as the alewife and sea lamprey, which require our continual attention in order that citizens may enjoy the benefits of a healthy fishery.)

- Fish management agencies are currently experiencing difficulty in determining adequate but not excessive salmonid stocking levels, in order to prevent windrows of dead (exotic) alewife on our spring beaches, to maintain water clarity through food chain manipulation, and to maintain fishery-related prosperity in coastal towns.
- Except in Lake Superior, managers are far from having rehabilitated lake trout populations destroyed by sea lamprey in the 1940's. In many areas, fishermen's catches cannot approach historical levels (without causing collapse of stocks) because of mortalities caused by residual populations of sea lamprey.
- Increased demands are made on sea lamprey control dollars by spawning lamprey exploiting connecting channels and newly clean waters. Costs of conventional lampricide escalate more quickly than inflation, while society's evolving sensitivity to chemical application necessitates development of new control strategies.

Legislation should be flexible enough to permit quick reaction to each new introduction, in order to determine impacts and options for control, if warranted. (Glenn legislation more flexible than Moynihan's, which addresses zebra mussel only.)

- The zebra mussel is not unique among exotics in its potential to harm ecosystems and human uses of the resource. Fishery managers fear that the ballast-introduced ruffe, which has exhibited exponential increase in numbers in its Duluth foothold, will impact important native fish such as yellow perch and whitefish through competition for food and predation on fish eggs.
- The spiny water flea, now reported in all five Great Lakes plus three of Ontario's inland lakes, has been associated with shifts in plankton communities and has become a major component of unknown value in some

native fishes' diets. Scientists are still studying the overall impacts of phenomena associated with the introduction of the spiny water flea.

Pipe and fish impacts of zebra mussel should not be the sole subject of legislation. Attention should also be paid to the entire spectrum of possible zebra mussel impacts affecting ducks, native clams, boat hulls, fishing gear etc. (Glenn is explicitly more comprehensive than Moynihan.)

The U.S. federal government (in consultation with Canada) should assist states in coordinating strategies for slowing or preventing spread of exotics with high likelihood of invading inland from Great Lakes. (Glenn's use of regional commissions best in this regard although more formal consultation with Canada would benefit both countries.)

The question of which agencies to use in responding to the zebra mussel etc. belongs to the Government of the United States (and Canada). The Commission does not seek this responsibility, but will discharge it to the best of its ability, if so assigned by Governments. We ask only that we not be assigned policy responsibility without program control and resources. Advantages of choosing the Commission include its jurisdiction over the entire Great Lakes, its binational nature, its track record with sea lamprey, and its existing arrangements and links with researchers and managers. However, the current mandate limits the Commission to the Great Lakes Basin, to study of issues affecting fish productivity, and to management of the sea lamprey. (Moynihan's use of Great Lakes Fishery Commission under its current mandate directs emphasis to zebra mussel impacts on fish in the Great Lakes. Glenn is more flexible in allowing the USFWS and NOAA to react to exotics wherever and whenever they become of concern in the United States.)

If either country should wish to use the Commission in responding to new exotics, it should consult the other and not engage the GLFC on a unilateral basis. (Glenn relies on the Commission's coordination function to provide informal link with Canadian researchers and managers. Moynihan relies on U.S. Section to work out details within GLFC before requesting funds from State Dept.)

Any required revision of the Commission's mandate and/or assignment of a new reference can be accomplished through exchange of notes between the two countries, as when the Convention was revised to permit 2 additional Commissioners (originally just 6).

- In order for the Commission to address non-fish concerns associated with exotics (such as zebra mussel impacts on pipes, native clams, etc.), the two countries should add to the Convention, a reference charging the Commission to advise Governments on issues pertaining to "aquatic organisms of common concern", as well as fish stocks of common concern.

- It may be possible for the Commission to address non-fish, non-pipe impacts (such as those possibly inflicted by zebra mussel on ducks and native clams), by invoking a broad (ecosystem approach) interpretation of the existing Convention.

- In order for the Commission to engage in hands-on control of exotics, it would need a revision to the Convention charging it to "minimize and eradicate" species other than sea lamprey.
- If the two countries agree to use the Commission in responding to exotics, they can ask the Commission for a recommendation on cost sharing, as occurred when the original 69:31 and 50:50 budgets were established.

Margaret Dochoda, Fishery Biologist
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TESTIMONY PRESENTED TO:

U.S. SENATE ENVIRONMENT AND PUBLIC WORKS COMMITTEE
WATER RESOURCES, TRANSPORTATION, AND INFRASTRUCTURE SUBCOMMITTEE

Presented by:
Charles R. O'Neill, Jr.
Regional Extension Specialist
New York Sea Grant Extension Program
19 May 1990

I wish to thank the Committee for the opportunity to speak before you this afternoon. New York Sea Grant, a university-based marine and coastal research and education program of the State University of New York and Cornell University, has been involved in public information, education, and research efforts pertaining to *Dreissena polymorpha*, commonly referred to as the zebra mussel, since October 1988.

Background

As the Committee is well aware, the zebra mussel has the potential to biofoul municipal and industrial water intake facilities and to interfere with commercial navigation and recreational boating throughout the Great Lakes Basin and the Northeast.

Since its initial "discovery" in Lake St. Clair in June 1988, the mussel spread into the western basin of Lake Erie by July of that same year. By Summer 1989, the Ontario Ministry of Natural Resources reported extensive colonies of up to thirty forty thousand mussels per square meter in the western basin of

Lake Erie. By the end of 1989, specimens were found in water treatment and industrial water systems and on beaches throughout Lake Erie as far east as Buffalo, New York. Today, the zebra mussel has become one of the dominant organisms in parts of the western and central basins of Lake Erie.

Zebra mussels were first reported in Lake Ontario in Port Weller, Ontario, west of the downstream end of the Welland Canal in November 1989. The mussel was found on a navigation buoy in Lake Ontario four miles off the mouth of the Niagara River when buoys were pulled at the end of the 1989 navigation season and in water intakes throughout the Niagara River by February 1990.

During routine maintenance of locks on the St. Lawrence Seaway this past winter, mussels were found in large numbers in the Snell Lock and in lesser numbers in the Eisenhower Lock, in Massena, New York. They have subsequently been found in service water strainers at an industrial facility downstream from the Snell Lock. In April 1990, a colony of zebra mussels, some up to an inch and quarter in length, was confirmed at the northeastern end of Lake Ontario on a cement plant pier in Kingston, Ontario, as well as in the New York Power Authority's Niagara River Power Project.

Dispersal

Biologists are concerned that the range of the zebra mussel will be expanded by transport of juveniles and adults by fish, waterfowl, crayfish, turtles, and other organisms. Also of concern are a number of human-mediated dispersal mechanisms. All zebra mussel age groups can be spread through intra- and interlake shipping, in ballast and bilge and by attachment to ship hulls; via inland irrigation from infested waterways; and via transit through canals. The discovery of mussels in Lake Michigan in Green and Sturgeon Bays and Duluth Harbor on Lake Superior is believed to be evidence of dispersal via interlake shipping.

A major dispersal vector will be interbasin transport from the Great Lakes into the Finger Lakes, Mohawk River and Hudson River via the Erie Canal and into the Mississippi River system from Lake Michigan via the Chicago Shipping Canal.

The inadvertent spread of the mussel from infested waters to inland waterways by anglers and recreational boaters is expected to be another major dispersal vector as a multitude of recreators travel from waterway to waterway in the pursuit of the biggest sportfish, the most scenic sailing, and the best boating. Larvae will be spread in boat bilge, live wells and engine cooling water systems. Juvenile and adult mussels can easily attach to boat hulls, engine stern drive units, and even boat trailers and can live several days out of water if they are not in direct sunlight. Kept moist (as they would be in bilge, live wells, and trailer frame channels) mussels could survive out of water for a week or more. Every time an angler adds water to a bait bucket the possibility will exist that mussel larvae will be added and transported, too.

How fast hitchhiking mussels will be spread in this manner is unknown. Scientists assume that within twenty five years the zebra mussel will be found throughout the Northeast as a result of human dispersal vectors. For example, a boat which spent time in Lakes Huron and Erie during 1989 later traveled to Oak Orchard

Creek in Orleans County and spent the weeks from August to the end of the boating season sailing Lake Ontario and its tributaries. At the end of the boating season, the hull was found to have numerous quarter- to half-inch mussels attached.

Impacts

Zebra mussels attach to nearly any hard substrate, including stone, steel, concrete, wood, plastic, and glass using dense elastic strands called byssal fibers. Zebra mussel colonies along lakeshores and riverbanks and on rock or gravel shoals can exceed one hundred thousand mussels per square meter.

The life span of a zebra mussel is highly variable, averaging around three and one half years. Typically, following introduction into a new water system, the mussel population undergoes a rapid explosion lasting for several years, followed by a crash and subsequent population oscillations until equilibrium is reached. Not always, though. In Sweden the zebra mussel population has yet to crash after ten years. The population expansion in Lake Erie appears to be more aggressive than in Europe, most likely due to the lake's highly suitable chemical, biological and thermal regimes.

Colonies of zebra mussels have the potential to affect commercial navigation and recreational boating. Mussels attached to ship and boat hulls increase the amount of drag and reduce speed and fuel efficiency. Larval mussels drawn into a vessel's engine cooling water intake can settle and grow if the vessel is allowed to sit idle for a prolonged period of time. Colonization can clog the cooling system leading to overheating and possible damage to the engine. Shells drawn into the engine can damage cooling system parts. Another impact on navigation and boating is the sinking of navigation and marker buoys as a result of the weight of attached mussels. This has already been observed in Lakes Erie and St. Clair.

The U.S. Fish & Wildlife Service has projected that the economic impact of the zebra mussel on sixty seven ships of the Great Lakes merchant marine fleet over the next ten years will be approximately sixty million dollars. Additional impacts of five million dollars resulting from biofouling of twnety five thousand smaller vessels is also likely to result.

Large zebra mussel colonies can encrust pilings and ladders on docks and piers, making those facilities to tie up to and speeding corrosion as a result of the mussels' waste excretions.

Zebra mussels are already fouling raw water intakes at electric power generating and industrial facilities and public water supply filtration facilities throughout Lake Erie and have been found in most intakes along the Niagara River. The continuous flow of water into intakes carries a continuous source of food for the mussels, transforming water intake structures such as intake cribs and trash racks into excellent habitat for mussel colonization. One Upper Great Lakes utility reported densities of seven hundred and fifty thousand mussels per square meter in its intake canal.

Impacts associated with such colonization include: loss of intake head; clogging of heat exchanger, cooling, lubricating, air conditioning, and fire fighting service and distribution water lines; obnoxious or dangerous methane gas production; and corrosion of steel and cast iron pipelines.

The worst-case economic impact of zebra mussels on electric generation has been estimated at more than eight hundred million dollars for redesign and sixty million dollars for annual maintenance and treatment of seventy two nuclear and fossil fuel power facilities across the Great Lakes Basin over the next ten years.

Along with electric power facilities, public and private water supply infrastructure throughout the Great Lakes Basin face some costly times ahead. It has been projected that over the next ten years, nine major cities, eleven small cities, and fifty small towns will spend over six hundred million dollars to redesign, maintain and treat their public water supply systems.

In addition, industries across the Great Lakes may need to spend more than four hundred million dollars over the next ten years for redesign and maintenance of manufacturing facilities as a result of zebra mussel infestations.

Zebra mussel control measures in power, water, and industrial facilities to date include physically scraping mussels from surfaces, oxygen deprivation, systematic flushing with hot water, chlorination or ozonation at the point of raw water intake or within water systems, use of organometallic antibiofouling coatings such as tributyltin oxide, and the use of molluscicides. None of these methods is a "silver bullet" but combinations of these and other alternatives will need to be used over the next several years to cope with the mussel until new "Best Available Technology" alternatives can be developed.

Needs

What is needed today throughout the Great Lakes Basin is a combination of monitoring, public information and education, and research. Monitoring of baseline ecological parameters on infested and soon-to-be infested areas, presence and spread of the mussel, and impacts of colonization is vital to our understanding of how North American waters are adapting to the presence of the organism.

Coordinated research into the basic biology of the mussel, life history patterns, limnological characteristics of preferred habitat, physiological requirements and physical environmental limits, cataloging of mussel parasites, calculation of zebra mussel carrying capacity of waterbodies, factors mediating invasion success or failure, dispersal vector control mechanisms, and potential biological controls is needed to determine long range resource management strategies and control methods.

A coordinated program to educate the public about the zebra mussel, its spread, and its impacts is essential to slowing the dispersal of the organism. Furthermore, the owners and operators of public and private water use infrastructure needs to be educated as to both short- and long-term methodologies for minimizing the impacts of the mussels. A combination of all three components -- monitoring, research, and education -- will help the U.S. to adapt to living with the mussel as western and central Europe have adapted over the past 175 years.

Since late 1988, the New York Sea Grant Extension Program has been very active in finding out more about the zebra mussel and in helping State and local government, electric utilities, industries, and water users (including tourists) cope with the zebra mussel invasion of New York waters. In November 1989, we published the first detailed factsheet in the Great Lakes region on the biology, impacts, and control of the mussel in the Great Lakes. That same month, New York Sea Grant Extension sponsored a two day international zebra mussel conference which attracted almost 200 participants and speakers from water treatment and power plants, industries, universities, and state, federal, and provincial resource management agencies throughout the northeast, Canada, and Europe.

In March 1990, New York Sea Grant Extension cosponsored, with a local State Assemblyman, a zebra mussel workshop designed specifically to inform the average citizen about how the mussel might affect his use of water resources. Similar public information meetings are planned later this month and in June across New York's Great Lakes and St. Lawrence coast, cosponsored by several State Senators, to reach those folks who will be affected by the mussels this year.

New York Sea Grant is currently funding a Buffalo State College research project to monitor the spread of zebra mussels through the eastern basin of Lake Erie, as well as to identify the mussel's impacts on phytoplankton populations.

In April, New York Sea Grant and the Great Lakes Research Consortium cosponsored a two-day workshop to identify immediate zebra mussel research needs and to develop research proposals for implementation when additional funding becomes available, thereby minimizing the time lag in getting underway. We are also helping to coordinate research and education activities with our colleagues, both in the U.S. and Canada, throughout the Great

Lakes Basin.

The New York Sea Grant Extension Program has received a grant of $99,400 from the Empire State Electric Energy Research Corporation (ESEERCO), a consortium of seven New York electric utilities, to establish the New York Zebra Mussel Clearinghouse for collection and dissemination of information on the mussel. The Clearinghouse, to be located at New York Sea Grant Extension's regional office at the State University College at Brockport, will be a depository and information and education source for all information currently available on the mussel from whatever sources we can identify, both in the U.S. and abroad. An additional grant of $2,000 for Clearinghouse educational programs has been received from the Monroe County Water Authority. The Clearinghouse will extend this information to any and all audiences who need it in a form that will be most useful to them in controlling the mussels' spread and minimizing its impacts. It will benefit a wide range of New York water users, from the electric generating utilities to anglers and beachgoing tourists.

New York Sea Grant believes that research and education programs on the zebra mussel need to be coordinated to ensure that duplication of effort is minimized and that resources can be pooled to maximize the impact of whatever research and education funds become available. As a research and education program that funds marine science research throughout New York's colleges and universities through a competitive grants program, New York Sea Grant is in a unique position to provide just such coordination. Sea Grant's research program expertise, coupled with its Sea

Grant Extension educational outreach capabilities can help New York in its battle against the zebra mussel.

Furthermore, Sea Grant brings to the battle the additional expertise of all of the Great Lakes Sea Grant Network programs, the National Oceanic and Atmospheric Administration, the Federal Extension Service, and top-notch scientists throughout the U.S., Canada, and Europe with whom we are constantly in touch, such as the Ontario Ministries of Natural Resources and Environment, the U.S. Fish & Wildlife Service, and the K.E.M.A. Institute in the Netherlands.

The zebra mussel is now well established in Lake Erie and has been found in Lake Ontario and the Niagara and St. Lawrence Rivers. While new control techniques will most likely be developed as a result of the mussel's invasion of the Great Lakes, most scientists believe that there most likely is no way to eliminate the mussel from North American waters without serious harm to other aquatic life forms. It must, therefore, be assumed that the mussel is here to stay and that it will eventually be found throughout New York and North America. New York Sea Grant is ready to assist the State and Nation however we can to control the mussels impacts on ecosystems and societal water uses.

Once again, I thank the Committee for this opportunity to address the zebra mussel situation.

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DREISSENA POLYMORPHA: AN UNWELCOME NEW GREAT LAKES INVADER

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INTRODUCTION

A new invader of the Great Lakes, *Dreissena polymorpha (Pallas)* (also known as the "zebra mussel"), has the potential to biofoul municipal and industrial water intake facilities, to disrupt food webs and ecosystem balances, and to interfere with sport and commercial fishing, navigation, and recreational boating and beach use throughout the Great Lakes.

ORIGIN OF *DREISSENA* IN THE GREAT LAKES

Dreissena polymorpha, native to the region of the Black and Caspian seas, was introduced into several European freshwater ports during the late 1700s. Within 150 years of its introduction, *Dreissena* was found throughout European inland waterways.

Although the actual pathway of the mussel's introduction into North America is unknown, it is believed that ships originating from overseas freshwater ports where the mussel is found carried the mussel in freshwater ballast which was discharged into freshwater ports of the Great Lakes. Although adult mussels are capable of attaching to ships' hulls, transoceanic transport of mussels in this manner is unlikely since the mussels cannot survive in saltwater for the time required for a transatlantic crossing.

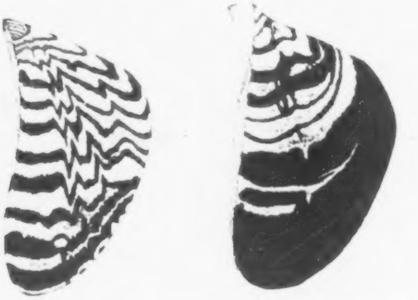
Dreissena was first discovered in Lake St. Clair in June 1988; the first confirmed sighting in the western basin of Lake Erie was in July 1988. By November 1989, specimens had been found in water treatment and industrial water systems in the Detroit River below Lake St. Clair, on beaches and in water treatment and industrial facilities along the north shore of Lake Erie as far east as Port Maitland, Ontario, at the mouth of the Grand River, and in water treatment plants and on navigation buoys along the south shore of Lake Erie as far east as Sturgeon Point, New York. Extensive colonies of up to 30,000 to 40,000 individuals per square meter were reported in the western basin of Lake Erie in the summer of 1989 by the Ontario Ministry of Natural Resources. Adult mussels were first reported in Lake Ontario in Port Weller at the mouth of the Welland Canal in November 1989. The mussel spread to Buffalo and the Niagara River by January 1990. There is a strong likelihood of interbasin transport of the zebra mussel from the Great Lakes system into the Mississippi River system via the Chicago Diversion and into the Finger Lakes, Mohawk River and Hudson River through the Erie Canal.

Given the age of zebra mussel specimens collected in the Great Lakes, the mussel is believed to have first been introduced into Lakes St. Clair and Erie circa 1986. Genetic studies on various specimens suggest entry into the Great Lakes from ballast originating from several European ports.

Biologists believe that the dispersal of *Dreissena* throughout the Great Lakes might be greatly enhanced by inter-lake freighter transport of veligers (larvae) in ballast and adult mussels attached to ship hulls. The recent discovery of zebra mussels in Green and Sturgeon Bays (Lake Michigan) may be evidence of this dispersal within the Great Lakes. There is some concern by biologists that the range of the zebra mussel could also expand into inland waterways, facilitated by transport of veligers by waterfowl and adult mussels attached to boats, crayfish and turtles.

BIOLOGY OF *DREISSENA POLYMORPHA*

Zebra mussels are small (5 cm and smaller) bivalve molluscs (relatives of clams and oysters) with elongated shells marked by alternating light and dark bands (Fig. 1). They possess dense elastic strands, called byssal fibers, by which they can securely attach to nearly any surface, often forming barnacle-like encrustations (Fig. 2). Because of an affinity for water currents, zebra mussels extensively colonize waterlines and canals, often to the point of severely reducing waterflow and, upon death, imparting a foul taste to drinking water (serious economic impacts in Europe since the late-1800s).



From: Morton (1969)

Figure 1 The origin of the name *polymorpha* can readily be seen in the variations in the light and dark banded shell markings on Zebra mussels.

Zebra mussels will colonize lakeshores and riverbanks where they attach to rock or gravel substrates, sometimes forming broad reef-like mats. In some European lakes, colony densities exceeding 100,000 per square meter have been reported with 15 cm deep shell accumulations from dead mussels on the lake bottom within two years (Fig. 3).

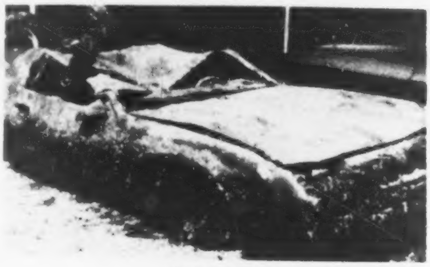


Photo: Ontario Ministry of Environment

Figure 2 Zebra mussels can attach to nearly any surface. This car, retrieved from the bottom of Erieau Harbor, Ontario, had the mussels growing on every surface including sheet metal, tires, fiber-glass, glass, even cloth seats.

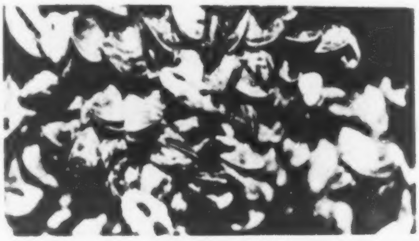


Photo: Ontario Ministry of Environment

Figure 3 Zebra mussels attached to rock or gravel substrates can reach colony densities greater than 100,000 per square meter with shell accumulations reaching 15 cm or more on the lake bottom.

The mussels are generally found within 2 to 7 meters of the water surface but may colonize to depths up to 50 meters. Colonization depths vary from lake to lake, but appear to be determined by light intensity and water temperature. *Dreissena* can tolerate a fairly wide range of environmental conditions. They prefer water temperatures between 20° and 25° C (68° and 77° F) and water currents 0.15 to 0.5 meters/second for proper growth.

In Europe, mussel densities tend to be higher in large lakes (surface areas greater than 485 hectares) with depths exceeding 35 meters, which are not overly enriched but

Water Temp. °C	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Criteria Studied
17-18	7.5		0.7	0.03		0	0	D.O. mg/l
	0		0	0		90	100	% dead
20-21	9.6	0.08	0		0			D.O. mg/l
	0	0	10.0		100			% dead
23-24	7.1	0.33	0	0				D.O. mg/l
	0	0	48.0	100				% dead

TABLE 1. Zebra mussel mortality rates at differing water temperatures and dissolved oxygen concentrations (Mikheev, V.P., 1968)

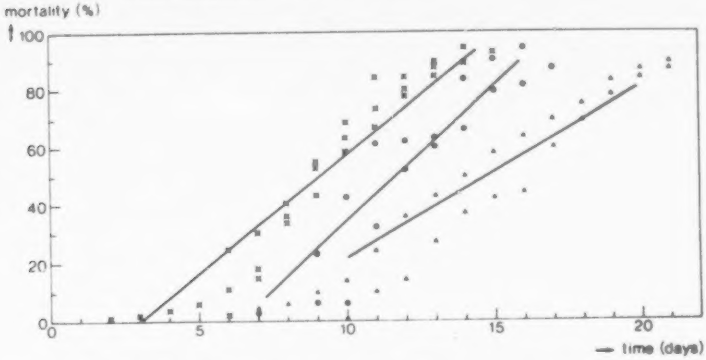
TABLE 2.
Relationship of zebra mussel size and mortality under anaerobic conditions [37 hours @ 22° C]
(Mikheev, V.P., 1968)

Length (mm)	% Mortality
1.0 - 4.9	100
5.0 - 9.9	61
10.0 - 14.9	34
15.0 - 19.9	2
20.0 - 24.9	0

Ion	(mg/l)	% Mortality	
Silver	2.5	40.0	20°C (68 F) 24 hour contact still water
	5.0	71.5	
	7.5+	100.0	
Mercury	5.0	57.2	
Zinc*	5.0	4.8	
Copper	4.0	100.0	
Copper	3.9	8.0	10°C, 20 hours running water
Copper	3.9	93.0	20°- 22°C, 20 hr. running water

TABLE 3. Effective of metal ions on zebra mussels
* Surviving mussels filter water, do not attach to substrate.
(Dudnikov, V.F. and V.P. Mikheev, 1968)

TABLE 4: Mortality rate of zebra mussel in laboratory experiments at 3 chlorine concentrations. Lines represent linear correlation. Water temperature = 12 - 15°C.



x = 1.0 mg/l Total Residual Chlorine; 3 exp. in duplicate; r = .972
o = 0.5 mg/l Total Residual Chlorine; 2 exp. in duplicate; r = .988
Δ = 0.25 mg/l Total Residual Chlorine; 2 exp. in duplicate; r = .956

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which have a high calcium content. Conditions generally considered as unsuitable for growth are water temperatures below 7° C (45° F) or above 32° C (90°), and water currents greater than 2 meters per second or rapid water level fluctuations. The mussels can withstand dessication for only a few days, depending upon atmospheric humidity.

Dreissena has a reproductive strategy unique to freshwater mussels which is responsible for its rapid population expansion in Europe and the Great Lakes. Sexual maturity is typically reached at age two. Mature female mussels can produce 30,000 to 40,000 eggs per year, as the water temperatures reach 12° C (54° F). Egg production generally continues in asynchronous batches and may extend throughout the year in warmer waters. In Europe, fertilized eggs are 4 to 7 microns long and become planktonic larvae (veligers) in 2 to 3 days when water temperatures reach 14° to 16° C (57° to 61° F). In Lake Erie 11° C (52° F) is the norm, with the Ontario Ministry of Natural Resources reporting veligers in water as cold as 8.5° C (47° F). Veligers are capable of active swimming for 1 to 2 weeks, enabling them to disperse considerable distances from the parent colonies. Daily vertical migrations of veligers have been reported in European lakes.

Within 3 weeks of hatching, the young mussels reach the "settling stage," where they can attach to bottom debris or other objects such as boat hulls and water intake cribs. At this life-cycle phase, the settling larvae can experience mortalities exceeding 99%, primarily from hypoxia, temperature shock, and failure to locate a suitable attachment substrate (which could result in larvae sinking into bottom sediments or into deeper, colder water).

During the first year of life, young mussels are capable of active crawling along the substrate at speeds over 3.8 cm per hour until they find a suitable location to attach. Sessile mussels develop byssal fibers and, for the most part, do not move. Younger overwintering mussels migrate to deeper (warmer) waters to escape from cold temperatures and ice scour. During the first growing season, young *Dreissena* may reach 5 to 10 mm.

The life span of a zebra mussel is highly variable depending on a number of environmental conditions. Life spans average around 3.5 years but can reach 5 years.

Typically, when *Dreissena* is introduced outside its native range, the relocated population undergoes a rapid increase in number, often by a factor of 2 to 3, lasting for several years after the initial introduction, followed by a marked reduction in population size and subsequent population oscillations. However, in Sweden the population of zebra mussels has not yet crashed after 10 years. The *Dreissena* population expansion in Lake Erie appears to be more aggressive than in Europe, most likely due to the lake's highly suitable chemical, biological and thermal regimes.

USE OF *DREISSENA* AS FOOD

Although adult zebra mussels (which offer a high nutritional value to predators) are regularly consumed in Europe by several species of fish, the overall impact upon mussel populations is believed to be insignificant. In some European lakes, crayfish predation on mussels 1 to 5 mm long is considerable, with adult crayfish (90 mm) consuming over 100 mussels per day (about 6000 mussels per summer). Crayfish, however, are believed to be ineffective predators in deeper lakes due to cooler water temperatures.

Studies indicate that bird predation rates on *Dreissena* populations are variable, ranging from insignificant to as high as 32% during the summer months and greater than 90% during the winter in some lakes. In Europe, waterfowl reportedly prey heavily on adult zebra mussels. In the littoral zone (water depths of 0 to 5 meters) waterfowl are considered to be the prime controller of zebra mussels. For example, Lake IJssel, in the Netherlands, supports a large population of diving ducks feeding on zebra mussels. Veliger and post-veliger larvae are also preyed upon by young fish and zooplankton, but to what extent this predation contributes to mussel mortality is unknown.

The value of zebra mussels as a human food source is also unknown. It appears that they may not be a viable human food because of the small size, a strong byssal attachment which would make them difficult to harvest, and a possible tendency to serve as a parasite vector (transmitter) to humans.

BIOLOGICAL IMPACTS

Using a siphon-like ciliated gill system, zebra mussels filter phytoplankton (microscopic plants and many forms of algae) out of water drawn into the mantle cavity. Laboratory studies indicate that the mussels can efficiently filter phytoplankton down to 0.7 microns but tend to mechanically select those particles between 15 to 40 microns in diameter. Particles of unsuitable size or chemical composition that are not ingested are coalesced into a mucus bolus (pseudofeces) and subsequently discharged.

On average, a single mature zebra mussel can filter about one liter of lake water per day. The rate of filtration is largely determined by phytoplankton concentration and sizes, water temperatures and mussel body size. European studies indicate that the phytoplankton filtration ability of the mussels can dramatically increase water clarity in lakes. Since the introduction of zebra mussels into the western basin of Lake Erie, Canadian researchers have observed a twofold increase in water clarity. The extent that this can be attributed to zebra mussel filtration of phytoplankton is unknown. However, it is very likely that *Dreissena* has played a role.

Since phytoplankton is the major food source for pelagic (open water) lake food chains, fisheries-related impacts could result from zebra mussel filtration activity. Excessive removal of phytoplankton from the water column could cause a decline in zooplankton species which feed upon phytoplankton. As a result, populations of zooplankton-feeding fish could also decline and, in turn, Lake Erie's important walleye fishery could be impacted. In addition, extensive deposition of mussel pseudofeces on the lake bottom could favor lakewide domination of bottom-dwelling species, especially in littoral areas.

Because *Dreissena* settles on rock cobble as an attachment substrate, there is concern that extensive colonization of shoal areas in the lakes could impair reproduction of species of fish (such as walleye and lake trout) which spawn only on rocky-bottomed areas. If this occurred, it could jeopardize the intensive Great Lakes lake trout restoration efforts being undertaken by U.S. and Canadian natural resource agencies.

In general, freshwater molluscs are important vectors of parasites in waterfowl, fish, wildlife, and occasionally humans. Many parasitic life-cycles involve the development of the parasite within the bodies of molluscs, which serve as intermediate hosts. Although zebra mussels are not considered as common parasitic vectors in Europe, they could potentially increase the spread of certain parasites, particularly as the mussel colonizes rapidly into the Great Lakes. Zebra mussels themselves show little effects from parasites.

NONBIOLOGICAL IMPACTS

Dreissena as a biofouler in raw water supplies

A major immediate impact that *Dreissena* infestations are having in the Great Lakes is the fouling of raw water intakes such as those at drinking water and industrial plants. Water intake structures (intake cribs and trash racks) serve as excellent habitat for mussel colonization. Since the continuous flow of water into intakes carries a continuous source of food for the mussel, such structures may, in fact, become a preferred habitat.

Dreissena is capable of attaching to firm substrates at water flow velocities below 2.5 meters per second on horizontal surfaces (2.0 meters per second on vertical surfaces, although researchers in the Netherlands have reported that flows of 1.0 to 1.5 meters per second are sufficient to preclude settling). The presence of zebra mussels in a raw water main is usually first detected by the discharge of shells into the facility's raw well, possibly accompanied by a noticeable decrease in head, as the mussels form layers up to 0.3 meters or more in thickness in intake mains.

Once in a facility, *Dreissena* may colonize any surface within the distribution system up to the first aeration or chlorination stage, including intake mains, raw wells, screen house walls, traveling or stationary screens, and settling tanks. The main impacts associated with colonization are: loss of intake head; obstruction of valves; putrefactive decay of highly proteinaceous flesh; obnoxious or dangerous methane gas production; and, electro-corrosion of steel and cast iron pipelines.

A similar water system fouling problem

can occur in power plants and industrial water systems which use an infested waterbody as their raw water supply for cooling, lubricating, and/or fire fighting purposes. In addition, in-plant distribution conduits and condenser and heat exchanger piping can become clogged, leading to overheating of vital components, loss of heat exchange efficiency, and possible safety hazards if sprinkler systems fail to deliver sufficient fire fighting water.

The rate of overgrowth of *Dreissena* from intake cribs and trash racks to internal distribution systems is dependent upon chemical and physical characteristics of the raw water, flow velocity, the three-dimensional position of the surface of the overgrowth, and the surface structure of the substrate. One Great Lakes utility has reported colony densities of 500,000 per square meter in its intake canal.

Impacts on navigation and recreational boating

Another *Dreissena* impact in the Great Lakes is on commercial navigation and recreational boating. The mussels have been found on the hulls of Canadian Lake Erie commercial fishing boats. As with any critter that attaches itself to hulls, this increases the amount of drag and reduces the boat's speed and fuel efficiency. If larval mussels are drawn into a boat's engine cooling water intake and the vessel is then allowed to sit idle for a prolonged period of time, colonization may occlude the cooling system, leading to overheating and possible damage to the engine. If shells are drawn into the engine, abrasion of cooling system parts could result.

Commercial and recreational navigation can also be impacted if navigation and marker buoys sink under the weight of mussel encrustations on the submerged portions of the navigation aids (this has been observed in Lakes Erie and St. Clair).

Dreissena can also detrimentally impact docks and piers. Large colonies can encrust pilings and ladders making them difficult to tie up to and speeding up corrosion as a result of the mussels' waste excretions.

Impacts on recreation

Recreational use of beaches in infested areas may also be impacted by colonization of shallow nearshore areas by the mussels and by littering of beaches by shells washed up from submerged colonies (bathers on some beaches of Lakes St. Clair and Erie are already reported to be wearing footgear to prevent cuts from the shells). Obnoxious smells from the decomposition of mussels can also detract from shoreline recreational activities.

CONTROL OF *DREISSENA POLYMORPHA*

The European and Soviet experiences indicate that it is best to eliminate *Dreissena* in water pipelines at the veliger stage or before the most rapidly growing post-veliger specimens are able to pass unhindered through the pipeline. Control can be continuous or periodic with the time schedule for elimination based upon the mussel's growth rate for the specific water body and the minimum openings in pipeline through which dead or living specimens could pass.

Physical and mechanical control alternatives

The first, and most evident, method for controlling *Dreissena* infestation of water treatment, power generation, and industrial facilities is to prevent entry of the mussel into such water systems (exclusion). This can be accomplished by the use of strainers and filters to prevent the entry of juvenile and adult mussels. The effectiveness of this method depends upon the mesh size of traveling and stationary screens and the size of the mussel.

The common traveling screen mesh used in water supply systems is 9 to 13 mm. The effectiveness of screens could be increased by reducing the mesh size. Also, this method is effective in excluding only those mussels which originate upstream of the screens. Any mussels living downstream of the screens would not be impacted. Additional service water strainers would exclude virtually all adult and most juvenile mussels that were not excluded by the initial screening. Centrifugal separation debris filters could be used to exclude most sizes of *Dreissena* but could also result in a loss of head in distribution lines.

Unfortunately, veligers would pass easily through both screens and service water strainers and perhaps centrifugal filters, as well, and would have to be eliminated in some other manner before they had an opportunity to settle and colonize within the distribution system. The possibility does exist to use microstraining fabrics with an aperture of 38 microns to keep veligers out of very sensitive portions of distribution systems. However, this would not be practical on a large scale.

Since *Dreissena* do not attach in high current flow areas (greater than 2.0 or 2.5 meters per second for vertical or horizontal surfaces, respectively), another control is to maintain intake and distribution system flows exceeding those rates. This may not be possible in existing facilities due to pipe and pump size, pipeline configuration, or other factors, but could be taken into consideration in the design of new facilities in infested areas.

Physically scraping mussels from water systems is also a viable method of control. The desirability and effectiveness of scraping depends upon the design and operational characteristics of the impacted system. Scraping is most effective in large conduits where mussels are found in high concentrations. This alternative is, however, very expensive (one Great Lakes water system estimates that this would cost $ 50 to $ 100 million in labor and lost production per year for their intakes).

In smaller pipes or pipelines which do not allow for direct access by workers, scraping may be accomplished by "pigging." The effectiveness of this method depends upon the design of the system and the intensity of the infestation. Pigging is not effective in systems with bends in the pipeline or where the infestation is so great that the large amount of dislodged mussels might obstruct the progress of the pig or cannot be effectively removed from the conduit. Pigging can be designed into new systems in infested areas.

Attachment of *Dreissena* on open surfaces (ie. trash racks and gates) can be discouraged through the use of pulsed industrial-frequency electrical currents. Generally, the higher the water temperature, the more rapidly the mussels will be affected. Experiments in the Soviet Union have shown that at summer temperatures a field intensity of 7 to 8 volts per centimeter for 27 to 31 hours is effective. The effectiveness of this method is similar using either a.c. or d.c. current.

Veliger settling in pipelines can be controlled by the use of electrostatic filters placed in a pipeline cross section. In this case, exposure time depends upon water flow rates. Veliger death can be assured by exposure to high voltage for 0.1 second. For such short exposures, 225 to 250 volts per centimeter would be needed for specimens with open shell valves or 380 to 400 volts per centimeter for those with closed valves, making this alternative technically impractical for most industrial situations. At higher temperatures and voltages, specimens die proportionately more quickly.

A "last resort" mechanical control for extreme situations is the removal and replacement of clogged tubing.

Avoidance control alternatives

For facilities that place marker buoys to locate intake cribs, it would be advisable to keep the buoy anchors well away from the intake structures to prevent veligers from settling onto the anchor cable and spreading down the cable to the cribs. Periodic scraping of the bottoms of the buoys is also advised.

Ultrasonic vibrations are also being researched as an avoidance methodology.

Oxygen deprivation control

Since zebra mussels "breathe" oxygen, oxygen deprivation, accomplished by hermetically sealing water intakes and isolated internal distribution lines, can be used as a control method. Since *Dreissena* utilizes oxygen most efficiently at 20° C (68° F), oxygen deprivation tends to work best in summer. Two to three days exposure to anaerobic water at 23° to 24° C (73.5° to 75° F) will result in 100% mortality (see Table 1). Oxygen can be eliminated from a sealed conduit using sodium metabisulfite with cobalt chloride as a catalyst. Hydrogen sulfide gas may be added to increase the effectiveness of the treatment.

A relationship also exists between mollusc sizes and susceptibility to oxygen deprivation, with small specimens dying first since smaller molluscs consume more oxygen than larger ones (see Table 2). Unfortunately, however, since *Dreissena* can survive several days of anaerobic conditions, any pipeline treated in this manner must be shut down and sealed for a number of days, a major drawback for most applications.

When eliminating *Dreissena* through oxygen deprivation, it should be noted that mussels in closed vessels die more rapidly when dead specimens are already present. There are several explanations for this: the appearance of disintegration products in water; extensive development of bacterial flora; and the rapid uptake of any remaining oxygen for oxidation (decomposition) and bacterial respiration.

Thermal control

Experience in Europe and the Soviet Union indicates that one of the most efficient means of controlling zebra mussel encrustations is the systematic and periodic flushing of water systems with heated water. Water temperatures must exceed 37° C (98.6° F) to kill the mussels, with water temperatures between 45° to 55° C (113° to 131° F) for a minimum of ten minutes resulting in the swiftest death of the most mussels of the widest size (life stage) range. In this temperature range, mussels tend to die with their shells slightly opened, promoting exposure and degeneration of byssal threads, followed by detachment of many specimens from the substrate (smallest, < 7.0 mm, mussels detach first). Mussels which remain attached must be mechanically scraped from the attachment areas. Treatments at temperatures greater than 60° C (140° F) results in immediate mortality. However, many mussels may die with closed shells and will remain attached for several days.

When utilizing thermal control, it is necessary to treat three times annually to remove adults and to target the more vulnerable early life stages of the mussel. The suggested annual treatment regime is early summer (June) to eliminate overwintered post-veliger specimens of the previous year, followed by second and third treatments in late summer (August) and fall (October) to eliminate the current year's post-veliger cohort. Each thermal treatment may have to be repeated several times during each of the three annual treatments to eliminate the greatest number of mussels. Mechanical scraping and cold-water flushing can be used after each hot water treatment to remove debris from major encrustations.

Metallic ion control alternatives

Experiments in the Soviet Union indicate that electrolytically dissolved metal ions in water may be used in low discharge pipelines and in underground and other inaccessible conduits to eliminate Dreissena. While discharge of many of these metals into the natural environment would not be permissible under state and federal regulations, some of the findings which might be applicable for use in closed systems are presented in Table 3.

When using metallic ions, larger mussels can be expected to exhibit a greater negative response due to incomplete hermetic sealing of their shells.

Chemical control alternatives

Use of **Copper sulfate** has been shown in Soviet experiments to be an effective zebra mussel control. However, at temperatures below 22.5° C (72.5° F), lethal doses of copper sulfate are so high (i.e., 300 mg/l at 17.5° C for 5 hours results in 60% mortality) as to be impractical considering corrosion of metal pipes caused by the copper. At temperatures above 27.5° C (81.5° F), lethal concentrations decrease to more practical values (e.g., 11.0 mg/l at 27.5° C for 5 hours yields 88% mortality). While such temperatures are seldom found in water treatment systems, water preheating combined with copper sulfate treatment may be feasible in some situations.

Chlorination at the point of raw water intake or within the system has been proven in Europe and the Soviet Union to be effective in controlling *Dreissena*. For example, in the Netherlands 0.5 mg/l of total residual chlorine for 2 to 4 weeks following spawning has been found to be effective in killing 95% of *Dreissena* (Table 4). Depending upon the time of year and size of the mussels, treatment may require up to 5.0 mg/l chlorine. This treatment method requires site specific testing to determine appropriate chlorine concentrations. Chlorine treatment is more effective in summer temperatures.

Continuous chlorination is feasible only for limited portions of industrial and power plant water systems that are highly vulnerable to infestation and/or are part of safety-related systems (this is not a problem in water treatment facilities).

There is concern for negative effects of chlorine on nontarget species. Therefore, dechlorination at the point of discharge is required. This is usually feasible but reduces the cost-effectiveness of treatment. There is also the risk that too high concentrations of chlorine can destroy the biological character of sand filters, result in obnoxious tastes and odors, and result in the need for dechlorination agents. In addition, an excessive rate of mussel killing can result in the putrefactive decay of the highly proteinaceous mussels, production of obnoxious or dangerous methane gas, and concentrated deposition of detached shells with a subsequent blockage of conduits. Chlorination of organic-rich water at the intake end of pipes may cause the formation of suspected carcinogens and is therefore not practical for public water treatment facilities.

Ozone is highly toxic to aquatic organisms but breaks down quickly into nontoxic end products and may be an alternative to chlorine. Concentrations are estimated to be in the same order as chlorine (0.5 mg/l).

Organometallic antibiofouling coatings such as tributyltin oxide may be effective to prevent *Dreissena* attachment to pipes, boat hulls and buoys, but are relatively expensive, difficult to apply, must be reapplied frequently, and may result in negative environmental impacts on nontarget species. Many such compounds are currently banned in the Great Lakes. Other coatings, such as silicon-based paints, may also be effective.

Molluscicides may also prove to be effective in industrial and power plant applications. Before using any chemical treatment method, readers are advised to check with local environmental regulatory agencies to determine legality of use for their situation.

SUMMARY AND CONCLUSIONS

Dreissena polymorpha is now well established in Lakes St. Clair and Erie and has been found in Lakes Michigan and Ontario and the Niagara and St. Lawrence Rivers. There is no way to eliminate the mollusc in these water bodies without harming other life forms, so we must assume that the mussel is here to stay and that it will eventually be found throughout the entire Great Lakes Basin and other inland waterbodies throughout North America. The task now is to control its impacts on ecosystems and water uses.

The control methods cited above will give readers an introduction to the mussel and its control. It should also be noted that new control alternatives will most likely be developed as a result of the invasion of the zebra mussel into the Great Lakes. Readers should augment this factsheet by refering to research reports available from Sea Grant, federal, state and provincial environmental management/regulatory agencies, and researchers.

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UNITED STATES SENATE

COMMITTEE ON ENVIRONMENT & PUBLIC WORKS

SUBCOMMITTEE ON WATER RESOURCES, TRANSPORTATION
AND INFRASTRUCTURE

John C. Malinchock

May 19, 1990

Good morning, Mr. Chairman, and distinguished members of the Committee. My name is John Malinchock. I am Environmental Supervisor for the New York Power Authority at its Niagara Power Project. I want to express my appreciation for your invitation to appear today before the Subcommittee to talk about an issue which is of critical interest to the Power Authority and its customers.

First, some background on the New York Power Authority. We are the nation's largest non-federal public power organization and provide about one-third of the electricity used in New York State. We are a nonprofit public corporation which finances, builds and operates electric generating and transmission facilities for the purposes specified in our legislative charter.

We own and operate two major hydroelectric power projects which are powered by the waters of the Great Lakes Basin. The Power Authority was in fact established in 1931 for the specific purpose of developing the American share of the hydroelectric power potential of the St. Lawrence River.

The St. Lawrence-Franklin Delano Roosevelt Power Project at Massena, New York, was licensed by the Federal Power Commission in July of 1953. The net rated output of the

St. Lawrence - FDR Project is 800,000 kilowatts and the average annual generation is approximately 7 billion kilowatt hours.

The Power Authority's other major hydro project, the Niagara Power Project, is located on the Niagara River approximately 4 1/2 miles below Niagara Falls. This Project operates using flows diverted from the Niagara River at a point 2 1/2 miles above the Falls.

Power from these two facilities is sold to 47 municipal electric systems and four rural cooperatives in New York State, and to three upstate utilities for the benefit of their rural and residential customers. Pursuant to federal law and State policy, the Projects also serve specified industries that directly employ more than 40,000 workers and are the economic backbone of Western and Northern New York. In addition, the power is sold for the benefit of millions of rural and domestic consumers in the neighboring states of Vermont, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey and Ohio. Each year, these Projects provide savings to electricity consumers and other economic benefits which exceed their combined construction cost of about $1 billion. In addition to their enormous economic benefits, these Projects have significant environmental and strategic value. The

Niagara and St. Lawrence - FDR Projects are directly responsible for the energy equivalent of about 35 million barrels of oil per year.

We also operate two nuclear power plants which are dependent on water from the Great Lakes and the Hudson River.

The J.A. FitzPatrick nuclear plant is located on Lake Ontario, in Oswego, N.Y. Power from the FitzPatrick plant is sold to utilities throughout the state, and half of its output is dedicated to fostering economic development. For example, FitzPatrick power has been provided to customers such as the Grumman Corporation on Long Island, Chase Manhattan Bank in Brooklyn, General Motors in Westchester and other companies throughout the State in return for expanding or maintaining their operations throughout New York State.

Indian Point No. 3, located the Hudson River, serves all of the electric needs of the public entities in Westchester and New York City including the Metropolitan Transportation Authority, The New York City Housing Authority, and city and county school districts.

It is apparent that the power produced by these facilities is vital to the economic health and well being of New York

State. These power plants, while not usually considered as "infrastructure," are as much a part of New York State's infrastructure as any highway, canal, or waterway.

The zebra mussel, by interfering with the maximum effective operation of these plants, could jeopardize the reliable economic supply of power to a wide variety of critical components of our society. At worst, power production from these facilities could only be replaced by more expensive, less environmentally-compatible energy sources.

Since its introduction into Lake St. Clair in 1986, the Zebra Mussel (Dreissena polymorpha) has spread rapidly to infest the Great Lakes system, having recently been observed in the St. Lawrence River near Messena. Left unchecked, the zebra mussel has the potential to infest the waters of much of the continental United States.

The Zebra Mussel is a serious biofouling pest in Europe, that appears to have found its own niche in North American water. Dreissena has the potential to foul municipal and industrial water intake facilities, disrupt the ecosystem, interfere with sport and commercial fisheries, navigation, recreational boating and beach use. In the 200 years that Europe has been dealing with this creature, methods have evolved for society to cope with its presence, such as dual intake structures to permit maintenance. Dreissena's sudden appearance in North American waters, and its aggressive reproductive rate, requires the users of the infested waters to respond to the serious threat that it poses. We lack the luxury of time to adapt to its presence. As the operator of major electric generating facilities utilizing Great Lakes waters, and several other facilities that will be impacted in the near future as Dreissena spreads beyond the Great Lakes, the New York Power Authority welcomes the interest of the Subcommittee in addressing the zebra mussel problem. Virtually 100% of our generation comes from thermal and hydro facilities on inland waterways. Looking at this another way, on an average day in 1989, the Power Authority's Great Lakes facilities produced over 25 billion kwh of electricity. Perhaps more important, production costs at our Niagara and St. Lawrence facilities are among the cheapest in the Unites States, and this power is critical to the economic well being of the customers it serves, both residential and industrial.

The utility industry has moved to cope with the Dreissena problem at several levels. At the national level, the Electric Power Research Institute (EPRI) has formed a Zebra Mussel Advisory Group to disseminate information, coordinate monitoring and control technologies, and fund appropriate research projects.

In New York State, the Empire State Electric Energy Research Corporation, which consists the state's seven investor owned utilities and the Power Authority recently executed an agreement with New York Sea Grant Extension for a Zebra Mussel Information Clearing House, essentially a technology transfer effort. Other projects under consideration include a zebra mussel monitoring project, to provide early warning of the mussels dissemination throughout New York waters; a project considering the use of sound as a control technology; and a proposal for bacteriological control.

Each user of Great Lake waters must face the eventuality of being impacted by Dreissena. At our Niagara Plant, the plant nearest the point of initial infestation by the zebra mussel, a monitoring program has been initiated, and a chlorine injection system has been designed. The first mussels were encountered within the plant last April. Monitoring has also been initiated at our St. Lawrence facility, and monitoring program is in place at our FitzPatrick plant on Lake Ontario.

The monitoring program which we have instituted at the Niagara Project will assess both the actual and potential impact of zebra mussels on the facility, as well as the effectiveness of our treatment system.

Beginning this Monday, May 21st, water column sampling using a modified Wisconsin Plankton Net will be conducted at the Lewiston Reservoir and the Moses Forebay. This sampling will allow us to determine the concentration of mussel larvae in the water column.

Zebra mussel collection plates (substrate monitor) have been placed in the Lewiston Reservoir, Moses Screenwell intakes, and at the Authority's Adam Slip located approximately 1/4 mile upstream from the Falls. These stations have been established to monitor settling and infestation rates. Eventually, the stations will be used to monitor the growth rate of the mussels.

The Authority has requested approval from the New York State Department of Environmental Conservation (DEC) to modify Niagara's State Pollution Discharge Elimination System (SPDES) to allow chlorination of the service water systems at the Moses and Lewiston Projects.

The service water lines at these Projects supply the cooling water requirement to various critical systems at each generating station, and are vital to normal plant operations.

As shown in the attached schematic drawing, the Moses Project service water chlorination system will consist of a 6,000 gallon storage tank of a 15% sodium hypochlorite solution (NaOHCl), secondary containment, two metering pumps, associated valves and piping, and an eight foot high security fence. A similar system, with a 3,000 gallon storage tank, will serve the Lewiston Project.

The initial chlorination solution feedrate for the Moses Project will range from 39 to 78 gallons per hour. The initial feedrate for the Lewiston Project will be 12.5 to 25 gallons per hour. At each Project these feedrates are expected to maintain an in-plant downstream total residual chlorine concentration range of 0.2 to 0.5 ppm. Once the necessary feedrate to maintain the required levels has been definitively determined, the solution will be injected two hours per day, seven days per week. Based on available water data, the Authority believes that chlorination will be necessary from May 15th to October 15th of each year for as long as the zebra mussel problem persists.

Your bill calling for research and technology development for control of Zebra mussels in and around public infrastructure is a welcome development. It will be an important tool in coping with the impacts from Dreissena. The information gained from this and other research efforts, such as those by the utility industry, will serve the public relying on Great Lakes waters today, and the rest of North America in the near future.

THE PROBLEM OF ZEBRA MUSSEL INFESTATION

SATURDAY, JUNE 23, 1990

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON WATER RESOURCES,
TRANSPORTATION, AND INFRASTRUCTURE,
Dunkirk, NY.

The committee met, pursuant to notice, at 10:37 a.m., in Dunkirk City Council Chambers, Dunkirk, NY, Hon. Daniel Patrick Moynihan (chairman of the subcommittee) presiding.

Present: Senator Moynihan.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator MOYNIHAN. We will now open the hearing. We thank our reporter, in advance.

This is a regular hearing of the Committee on Water Resources, Transportation, and Infrastructure of the Committee on Environment and Public Works of the United States Senate. It is a field hearing, obviously. We are here in Dunkirk. And we are addressing this rather extraordinary appearance in our country—for instance, in the Great Lakes—of the zebra mussel.

Bill and I have just been over at the Niagara Mohawk, and if anybody would like to know what a zebra mussel looks like, that's one. It is alive. If you look up close, it is striped like a zebra. We will introduce these in evidence, just picked up. This is Exhibit No. 1. If anybody wants to see them, come up and look.

This is, as I think we are beginning to learn, although it comes very suddenly, a fresh-water mollusk. It originates in sort of central Russia in the Caspian Sea region. It migrated across Europe to Western and Northern Europe. As far as we know, it made its appearance in the United States, working back from the numbers that are present, we assume in 1987. It was most probably brought here in ballast water of a freighter that took on ballast in a harbour in Northern Europe.

If you like the ironies of life, the best explanation we have about why it never got here before was that the water in those harbors was so polluted it couldn't live. Then they cleaned up the waters, and it started thriving. The next thing you know, we have it here.

It was first seen on the French side of Lake Saint Claire, which is the little lake that connects Lake Michigan with Lake Erie. It has spread. In the course of three years now it has reached Ogdensburg, across Ontario, up Ontario to the Saint Lawrence, and it was sighted about a month ago in Duluth, Minnesota. So it is from Quebec to the Great Plains.

We have to assume that it will spread to the surface waters of the whole of the United States in the course of the next 20 years. The Erie Canal System will take it down into the Hudson—I think it should be in the Hudson already, Bill. That will take it up to Lake Champlain. It doesn't take much to get from here to the Mississippi. I guess we take a certain amount of lake water that goes down into the Mississippi at Chicago regularly every day. And then there is no stopping it from there.

The problem is a very simple one: this mollusk will infest water systems and clog them up very easily. This is a sample of culture growth, this is about a three-inch pipe you see here. That is about six months' growth. It is pretty obvious you can't get any water through there. In small cities and towns along the lakes, we are already finding water systems have clogged up. Water pressure drops. Schools have had to be closed. This is going to be a devil of a problem. We are not going to die of it, but we are going to wish we had never heard of it.

That does it for my opening remarks.

Sir, would you like to say something before we get on with our distinguished witnesses?

Mr. **PARMENT**. I would just add to what you have said. My welcome to you, Senator, and my thanks to you for holding a hearing here in Dunkirk. This is a very troubling problem for our community, and it affects more people than we would like to think, in that it affects not only municipal and institution water intakes, but it will affect the fisheries. As you mentioned, it will be transported to the inland lakes and waterways. Even here in this county we are concerned that the water from Lake Erie will be carried to our lake on boat propellers, or whatever, and that it will soon be a problem not only for the people here in the City of Dunkirk and along the Lake Erie plain, but across New York State and across the country.

We appreciate very much your coming to Dunkirk to hold a hearing on this topic, and I'm sure that we will gain some information and knowledge about it, and hopefully that can be used to build a foundation for an action to at least help control this mussel and to keep it from being a devastation to our communities.

Senator **MOYNIHAN**. My colleague and friend Congressman Amo Houghton had hoped to be here. He is in Chautauqua with a group of European parliamentarians. We will make his statement a part of the record.

[The statement referred to follows:]

STATEMENT ON ZEBRA MUSSEL

by CONGRESSMAN AMO HOUGHTON

June 23, 1990

Sorry I couldn't be with you today. I was locked into another commitment before I learned of the hearing and couldn't rearrange my schedule. Never-the-less, the hearing is timely and extremely important to the Southern Tier -- as well as other fresh water environments.

For little creatures -- the zebra mussel has generated enormous problems! These are well documented. Just look at the impact on Dunkirk. The Niagara Mohawk Power Plant has been infected with the creature. The result -- physical blockage of pipes, foul taste and odor, harmful parasites and damage from broken shells. The issue is real. It is dangerous. It must be addressed now.

Let's look at what is being done. In the Great Lakes, the National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory is beginnning focused research on the zebra mussel and other exotic species. Others turning attention to these problems include the US Fish and Wildlife Service, the Great Lakes Fishery Commission, and the University Sea Grant Programs throughout the region.

I can comment on recent House action. The good news is that money has been included in the FY91 Commerce, State, Justice, Judiciary and Related Agencies Appropriations bill. This bill came before the House this past week. Final passage is expected this coming Tuesday. Let me spell out what is in the bill:

* $1.6 million has been added to restore the proposed cut to the Great Lakes Environmental Research Laboratory (GLERL).

* $1 million to be dispersed through GLERL to zebra mussel research.

* $1 million for a new research vessel.

* $1.4 million has also been included for sea lamprey control programs.

This is a good start -- it recognizes the importance of the problem.

On one further note, I am working with the Office of Technology Assessment to develop a proposal to study the problem of exotic foreign species infilitrating the nation's fresh water systems of lakes and rivers. The request will ask for a special case study on the zebra mussel. The proposal should move forward within a couple of weeks.

Senator MOYNIHAN. We are going to hear from some very able scientists this morning who will speak to those subjects. But first, Mr. Mayor, if you would come over, sir, we welcome you to your council chambers. We thank you for the courtesy of providing us this setting. Please proceed exactly as you wish, sir.

STATEMENT OF HON. GREGORY KRAUZA, MAYOR, DUNKIRK, NY

Mayor KRAUZA. Thank you.

I would like to welcome you, Senator, to the City of Dunkirk, along with Assemblyman Parment, and thank you for your deep concern regarding the zebra mussel situation, in general, and Dunkirk, in particular.

The City of Dunkirk is in a unique and tenuous position. This non-indigenous predator has invaded the Great Lakes and threatened water intake systems and natural fisheries. In the Dunkirk Harbor, the zebra mussel has infested the municipal water intake, with the potential to restrict industrial and domestic use. It has infested the Niagara/Mohawk water intake, which supplies electricity to much of Western New York, and which is the largest taxpayer in the city. And it has infested our fisheries, threatening one of the world's greatest walleye and small-mouth bass sport fishing areas.

Dunkirk, upon identifying this problem, contacted our elected officials at all levels, going as far as sending samples of zebra mussels to them. Our officials were quick to respond: the State of New York through a $50,000 initiative grant to the city; and the Federal Government through the Non-Indigenous Aquatic Nuisance Act of 1990, co-sponsored by you, Senator, as the ranking member of the Committee on Environment and Public Works.

My Administration has put together a plan to address the zebra mussel situation. Public works director Mike Bednar will elaborate on that during his testimony. This will be possible due to the Federal and State Governments' quick and effective response, and will forge a partnership between government, higher education, and the private sector.

Once again I want to thank you and welcome you for coming to Dunkirk, both Senator Moynihan and Assemblyman Parment, and for addressing our very serious problem.

Senator MOYNIHAN. Thank you, Mr. Mayor. Don't leave, if you can spare just a moment.

What are you hearing from the biologists? You are absolutely right: we will find ourselves thinking about the water intake systems that affect powerplants and irrigation systems and water systems, and they can freeze up and make a very real crisis for you and a very costly one as the powerplants find they have to cut back production. We also have here, in Lake Erie, the world's largest fresh-water fishery. I think that is a fact. This mollusk is devastating to the phytoplankton, isn't it? This is the very beginning of the food chain, the phytoplankton. This is what the mussel lives on, and as it uses it up, the food chain just sort of withers all the way up to where you get walleyes. Have you heard much about this?

Mayor Krauza. Not only does it affect the food chain, but it also attaches itself to the fish, which has created problems throughout all the fishery breeding grounds.

Senator Moynihan. It does?

Mayor Krauza. In fact, our local newspaper, the Observer, has run pictures. I have been told by many sport fishermen that they are catching fish that have the creature attached to it.

Senator Moynihan. In the manner of that lumprey eel that we had. But the one point I guess we all want to keep in mind is that the eel looked like an impossible problem, and yet we solved it. A very able member of the Fish and Wildlife Service did so. He went through 6,000 poisons before he finally got one that really does work. Lampreycide is the word. It ruined his health and everything else, but he did the job.

We are only at the outset of this. The Europeans know a lot more about it than we do. Bill and I were at the Niagara/Mohawk, and they had been visited recently by some people from the Netherlands who cope with this on a regular basis and have done so for a long time.

So the idea is that we should look forward to managing and getting on top of it, but the sooner we do, the better, because it will spread at an incredible rate. In 10 year's time, if we don't have some specific countermeasures within the next five years, we are going to be thinking about nothing but this problem in the early 21st century or so, I would say.

Senator Moynihan. Mr. Parment.

Mr. Parment. I have no questions.

Senator Moynihan. Mr. Mayor, thank you very much. Again, thank you for your courtesy and for your initiative in having gotten to this thing right off, as you did. You are distinctive in that regard.

Mayor Krauza. Thank you very much.

Senator Moynihan. Now we are going to have a panel of scientists. We are very pleased to have Randy Eshenroder, who is the Senior Scientist with the Great Lakes Fishery Commission; and Philip Weller, who is Executive Director of Great Lakes United.

Gentlemen, we welcome you both. Again, I see that you have prepared statements. Go ahead exactly as you choose.

First, as we listed here, Mr. Eshenroder, you are the Senior Scientist of the Great Lakes Fishery Commission, and we are very pleased to have you here and we thank you for coming.

STATEMENT OF RANDY ESHENRODER, SENIOR SCIENTIST, GREAT LAKES FISHERY COMMISSION

Mr. Eshenroder. Thank you, Senator Moynihan and Mr. Parment, ladies and gentlemen, gentlemen of the jury——[Laughter.]

Senator Moynihan. They do look——[Laughter.]

Mr. Eshenroder. You had me worried here.

Senator Moynihan. You'd better get it right. That's all I'll tell you. [Laughter.]

Mr. Eshenroder. In speaking on behalf of the Great Lakes Fishery Commission regarding its potential role in the management and control of zebra mussels as proposed by Senator Moynihan, my testimony must be characterized as preliminary because not all commissioners have had adequate opportunity to discuss this important matter. However, the Commission is prepared to carry out, to the best of its ability, any charges given to it by the U.S. and Canadian Governments. Our preliminary conclusions on how we would conduct a program follow.

The Commission would almost certainly approach the problem with broad-based, information-needs-determining workshops, followed by requests for proposals and research contracting; however, there are certain immediate needs which would be addressed concurrently with a granting process. These immediate needs would include reviews of literature—this would certainly be an emphasis on European literature—support for molluscicide registration research, transfer of available information, and establishment of protocols for containment of zebra mussels to the Great Lakes.

Literature reviews and research on molluscicide registration would be accomplished through contracts with government or academic researchers, whereas information transfer, containment protocols, and the granting process would be conducted internally. These activities would entail the addition of new staff.

Control of zebra mussel infestation on infrastructures, especially water intakes, is very important. Information on the zebra mussel's biology and ecology is required as a priority in order to determine its vulnerability to control measures. Experts from universities, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration—and Canadian counterparts—would be consulted, and their conclusions published.

The Commission has an enviable record in developing and disseminating research. Requests for proposals on mussel biology and ecology would be circulated and contracts issued subject to peer review and recommendation by scientific panels.

Control technology information needs would be similarly determined and published using integrated pest management principles to which the Commission subscribes in its sea lamprey control program. Input would be sought from entities such as the Corps of Engineers, the Electric Power Research Institute, Ontario Hydro, the U.S. Fish & Wildlife Service, academia, the States, and Province. Once again, requests for proposals would be circulated and contracts issued subject to peer review and recommendation by scientific panels.

The Commission sees information transfer as an integral part of its current mandate; however, given the magnitude of information transfer needs with the zebra mussel, and the Convention charge to use government agencies in performance of its duties, the Commission would like to establish transfer networks to maximize its effectiveness—that is, we would probably use the existing type of linkages such as with the sea grant institutions.

Quantifying ecological impacts of the zebra mussel in the Great Lakes would be a first objective of the workshop/RFP/granting process. If needed, control technology for the open waters would be the second objective. Input would be sought from community ecologists in the Fish & Wildlife Service, NOAA, universities, and their Canadian counterparts in documenting and meeting information needs. A need for the Commission to engage in hands-on control for the open waters is a decision that the governments would make based on the demands of the technology, the situations to be addressed, and the capacity of existing entities to mount an effective, efficient control program.

With regard to inland areas beyond the Commission's jurisdiction, our role would likely be limited to development of protocols to contain the spread of zebra mussel. In addition, of course, information gained from the Great Lakes' experience would be shared with other potentially affected parties.

Preliminary estimates of costs for fiscal year 1990 operations total approximately $1 million. There is a $6 million estimate for subsequent years, and that was based on existing U.S. contributions for our sea lamprey control program. These figures—especially the $6 million—could be adjusted upward or downward, depending on perceptions of the seriousness of the problem and the speed with which solutions are needed.

I would like to make a few comments about the Fishery Commission and how it could be effective in the Great Lakes area on this particular problem.

One, we do have a jurisdictional responsibility for the entire Great Lakes and its tributaries. The Commission represents Canada and the United States. We are currently involved in a control program on another aquatic nuisance, the sea lamprey. As part of this program, we have experienced personnel and facilities that already deliver a successful pest control program.

We have an infrastructure of committees that includes a variety of institutions on the Great Lakes—Federal, State, provincial, tribal, academic, and public. So we are already recognized as a coordinating, information-disseminating institution.

And we are already being asked by State and provincial fishery management agencies to take a leadership role with respect to exotics, including the zebra mussel. We also do coordinating work on the ruffe, which is a fish that was inadvertently introduced in Lake Superior, probably by ballast water; the spiny water flea——

Senator MOYNIHAN. That's about a three-inch fish, isn't it?

Mr. ESHENRODER. It's a little three to five-inch fish that has been introduced to Western Lake Superior. It may be as big a problem as was the sea lamprey, as may be the zebra mussel.

There is also a crustacean called the spiny water flea. You may have also heard it called BC, the initials of its scientific name. It is coming to prominence in the Great Lakes. Its impacts are unknown right now.

So the Commission is already involved in a number of these nuisance introductions. However, for the Commission to work and develop a program more than it is doing now on zebra mussel, we would have to have new terms of reference. We would have to be charged appropriately by both governments.

In my written testimony I have a number of things that could be pursued. I won't go into them here, because there is so much.

Senator MOYNIHAN. We're in no hurry, sir.

Mr. ESHENRODER. Okay. Do you want me to go through some of these?

Okay. I'd be happy to.

There are several options here as to ways this problem might be approached through the Great Lakes Fishery Commission.

Currently, we have a convention. We operate off of a convention, which is essentially a type of treaty established between Canada and the United States.

Senator MOYNIHAN. The 1955 Treaty.

Mr. ESHENRODER. The 1955 Treaty. That gives us our terms of reference and our charges. We deal right now with fish stocks of common concern. Of course, the zebra mussel will have impacts on fish stocks, but I'm sure the Commission would feel it would be appropriate if its mandate was clarified in this area. There could be some language, for instance, on aquatic organisms or aquatic-introduced pest species of common concern, or something to that affect.

We could, as I just alluded to earlier—because zebra mussels and all the other elements of the ecosystems weave together, we have a broad responsibility for fisheries— approach it in that way, looking at a kind of ecosystem-type of approach. That would be a second way of doing it.

Third, if the governments wish the Commission to engage in hands-on control of exotics other than sea lamprey, a revision to the Convention to minimize and eradicate species other than the sea lamprey would be required. That is, if we go into actual hands-on control, there would definitely need to be a change in the Convention. The Convention very clearly assigns the Commission the responsibility to conduct sea lamprey control operations, and I think to get into any zebra mussel control operations, it also should be clearly stated.

Lastly, if the two countries agree to use the Great Lakes Fishery Commission in responding to exotics, they could ask the Commission for a recommendation on how to work out the cost sharing. Right now, with sea lamprey control, costs are shared 69/31 between the United States and Canada, and that is based on a value of lake trout and other fisheries at the time the Convention was signed in 1955. So there would have to be some administrative items cleared up between the countries, but our sense of it is that there is a—the Canadians are faced with the same problem that we are faced with in the United States, and they want to work intensively on the zebra mussel problem. They are very concerned about coordination and any type of overlap or redundancy with U.S. programs, also.

I will conclude my testimony with that and take any questions.

Senator MOYNIHAN. Are you aware that the Committee on Foreign Relations has reported legislation that provides $6 million? The text says:

> Six million dollars shall be made available by the Secretary of State by grant or otherwise to the Great Lakes Fishery Commission for the purpose of enabling the Commission to establish and implement a program for the management and control of zebra mussels in the Great Lakes.

Mr. ESHENRODER. Yes. That was the authorization?

Senator MOYNIHAN. That's the authorization. Our problem is that we report this bill out, but this bill never gets passed.

Mr. ESHENRODER. You don't have to spend anything.

Senator MOYNIHAN. It gives $6,640,000 for the Great Lakes Fishery Commission sea lamprey control program. But we have in the water bill, which is on the floor, which I will be managing in about 10 days, and which will surely pass the Senate. We have to get a bill through the House. That provides funds for the Corps of Engineers, but to get funds for the Commission we'll probably have to go directly to the appropriations committee. We'll get the money.

But I see you have some specifics here. I think, somebody has to write a letter to the Commission and say, "You tell us what should be the ratio of expenses, how you think you ought to go about it." I went down and visited with the Canadian ambassador about two weeks ago, and they're ready. We have an organization in place that knows how to do these things. At this point, we need the Commission to tell the Congress what the Commission needs. You will know more than we do.

But why don't we hear from Mr. Weller, and then we'll continue questions.

Mr. Weller, on behalf of the Great Lakes United, we welcome you. It is a fine institution you represent.

STATEMENT OF PHILIP WELLER, EXECUTIVE DIRECTOR, GREAT LAKES UNITED

Mr. **Weller**. Thank you, Senator Moynihan. I very much appreciate the opportunity to be here this morning to testify. I'd like to thank all of those that have come, as well, to try and share in some of the solutions for this particular problem that we are all faced with in the Great Lakes region.

My name is Phil Weller, and I am Executive Director of Great Lakes United, which is a binational coalition of 180 groups from throughout the Great Lakes/Saint Lawrence River ecosystem. Our membership includes: environmental organizations, community groups, unions, small businesses, academic and scientific groups, hunters, anglers, boaters, and governmental bodies; and extends from Duluth at the western end of the basin to Quebec City along the Saint Lawrence River outflow of the system.

This statement is being made on behalf of this community of organizations who are deeply concerned about the condition of the Great Lakes system.

During this presentation I would like to convey three essential messages. The first of these is that there is an urgent need to prevent the introduction of exotic species into the Great Lakes. Secondly, zebra mussels have infested the Great Lakes and there is a need for action to monitor and respond to the threat posed by this tiny invader. Third, it is imperative that, in controlling the zebra mussels, we do not introduce cures that are worse for the health of the Great Lakes and the people who live here than the disease we are trying to manage. I would like to address each of these points in turn.

The introduction of the zebra mussel into the Great Lakes was preventable. Once in the Great Lakes, the zebra mussel and other exotic species, some of which we have heard about earlier, are difficult if not impossible to control. The best and most effective method of addressing the problem of introduction of exotic species into the Great Lakes is to simply prevent them from ever getting here.

While the door cannot be shut on the zebra mussel, the door can be shut on other potentially damaging organisms that could be introduced to the Great Lakes. The zebra mussel dilemma we are now faced with can and should be a powerful message to us of the difficulty of addressing problems once they are in the lakes. Like toxic chemicals which cannot be mopped up once they are in the lakes, exotic species must be prevented from entering the system.

To prevent introductions or spread of exotics, foreign ships have been asked to voluntarily exchange their ballast water in the open seas or in the Gulf of Saint Lawrence. The 83 percent voluntary compliance rate is encouraging, but 173 ships annually are not complying. It takes only one ship to introduce a pest such as the zebra mussel. It is therefore imperative that a mandatory ballast exchange program and rigorous monitoring system be in place to assure compliance. Such a program must be coordinated with Canadian shipping authorities. Only through prevention will we truly be able to protect the Great Lakes from the damaging impacts of exotic species.

Other speakers here today will outline for you the extent of the zebra mussel invasion, and I don't need to do that for you. What I would like to do is point out that there is a desperate need for research on the distribution, spread, and possible control of the zebra mussel. Strategies to effectively manage the zebra mussel problem cannot be undertaken out of ignorance. It is imperative that there be substantial resources and research efforts devoted to learning about the zebra mussel.

From our conversations with sportsmen, university researchers, and government scientists, it is clear that there is a great deal that is not known about the zebra mussel, and there is a compelling need to fund research directed towards an expansion of our understanding. It is particularly important that we maintain basic survey information on the distribution and abundance of zebra mussels throughout the Great Lakes. Research on the life cycle, habitat preferences, and impact on other organisms are extremely important.

Finally, we need to undertake research on possible controls. Europeans have learned to cope with the zebra mussels, and we need to turn to them for possible insights into our own problems. Two areas are particularly worthy of our research effort. These are: ballast treatments that are environmentally sound and effective, and environmentally sound mussel removal methods for water intakes and boat hulls.

Finally, I would like to stress that it is imperative that the solutions that are adopted—if there are any that are complete—must not contribute to or create other equally or more damaging impacts elsewhere in the ecosystem. For example, chlorination and other chemical control measures have been proposed for water intakes and other problem areas. These approaches, however, should be treated cautiously. Available evidence indicates that chlorination of water intakes may cause the formation of trihalomethanes. These halomethanes are potentially carcinogenic and could affect the quality of drinking water.

We are concerned, as well, that the extensive use of poisons to control zebra mussels will kill or damage populations of native organisms. We recently reviewed a proposal from a company in Ohio that applied for a permit to chemically control zebra mussels at a Lake Erie power plant. That proposal was made without full documentation of the need for the control at that site, and without exploration of physical cleaning or other non-chemical approaches. The zebra mussel is a significant threat to the health of the Great Lakes ecosystem, but we cannot loose sight of the fact that that control must not damage the ecosystem in other ways. We cannot approach the zebra mussel dilemma with a "kill the clams but damn everything else" attitude.

In conclusion, I would like to offer encouragement to Senator Moynihan for his efforts to get Congressional action that is consistent with the three points that I have addressed, and I would like to thank the Senator again for the opportunity to testify here. I look forward to the success of our collective efforts to conserve and protect the Great Lakes ecosystem.

Thank you.

Senator MOYNIHAN. Thank you, Mr. Weller.

Mr. Weller, are you by chance Canadian?

Mr. WELLER. Yes, I am. It is a binational organization composed of Canadian and U.S. organizations. I, as the executive director, was chosen from a field of candidates from both the United States and Canada.

Senator MOYNIHAN. How do you suppose I divined the fact that you are Canadian?

Mr. WELLER. I probably used the word "process" or some other tipoff. [Laughter.]

Senator MOYNIHAN. Repeat after me: what are you talking about?

Mr. WELLER. What are you talking about?

Senator MOYNIHAN. About.

Mr. WELLER. About.

Senator MOYNIHAN. I heard it. It came through.

Listen, what you have said is very important. Don't you agree, Bill?

Mr. PARMENT. Yes.

Senator MOYNIHAN. We have to find techniques. I think, obviously, the Commission is sensitive to this. We are going to have to find a mollusicide as we did finally in the case of the sea lamprey. It affects one thing and one thing only. But if, as you say, you kill the clams and to hell with everything else, that is exactly what you don't want to do.

We were met over at Niagara Mohawk this morning by Mr. Kantowski. Mr. Kantowski here?

Mr. KANTOWSKI. Here, sir.

Senator MOYNIHAN. Oh, there you are. Niagara Mohawk is working entirely at this point with thermal processes. They just heat their water in the system to the point where these creatures die off at about 90 degrees fahrenheit, or somewhere around there. But how we do it obviously is something we don't yet know.

I wonder if I could ask you, sir: what is known about mollusicides? I am sure you have looked it up a little bit by now. People in the Commission must have some general feelings about the subject. Is there, in Europe, a pattern of mollusicide use?

Mr. **Eshenroder**. To be honest, what they are using in Europe I am not familiar with. At the Commission we have essentially five scientific supervisory staff who administer a $10 million program. Until a year ago, this wasn't a part of our program. So, outside of Margaret Dochoda, who has worked hard on this problem, our staff has worked hard to avoid this because we can't afford to get in it any deeper than we have.

Senator **Moynihan**. She testified at the Alexandria Bay hearing—very able.

Mr. **Eshenroder**. We have an expert on staff who is not here today, but we do have experience with molluskicides. In fact, one of our lampricides is a mollusicide. It is called Bayer 73. We currently use today a molluskicide to control the sea lampreys. It is used in two ways.

In certain streams that have high Ph, we have found that if we put a small amount of the mollusicide in with our regular lampreicide, which is called TFM, that it reduces the amount of the TFM we need to use considerably, so that the two chemicals together are much less costly to use in a lower dosage. It makes the lampreys more vulnerable to the TFM. So we use it in that way.

We also use it to do surveys for lamprey larvae in the shallow water areas.

So we already have permission from the U.S. and Canadian Governments to use a mollusicide for sea lamprey control. We are not registered to use it for control of mollusks.

Senator **Moynihan**. But the first fact is that there is such a thing. There is a mollusicide—a range of them, actually.

Mr. **Eshenroder**. There is a range of them, and there is a disease in Africa called schistosomiasis.

Senator **Moynihan**. Of course.

Mr. **Eshenroder**. There has been a lot of work done on trying to control mussels, particularly because of this disease.

Senator **Moynihan**. For those of you that are not sufficiently appreciating life on the shores of Lake Erie, that is an absolutely dreadful disease that has spread through Africa. The disease is spread in the mollusk. One of the unanticipated affects of the high-level dam in Aswan was to bring it into lower Egypt. It just is fearful. It is endemic in about half of Africa right now. It is a wasting disease. It is kind of the social equivalent of malaria. You get it and you don't quite die but wish you did.

Winters are a little tough around here from time to time, but there are many advantages of the Great Lakes.

I'm sure you would agree, Mr. Weller, that our principal organizational approach should be through the commission? Would that be your view?

Mr. **Weller**. I think one of the things that Mr. Eshenroder pointed out earlier was the importance of coordination. I think the Fisheries Commission offers probably the best mechanism for coordination. It has been operating since 1955 in cooperation with the Canadian Government on the sea lamprey problem and other fisheries problems, as well as working very closely with the States. And it certainly provides the best mechanism to achieve the coordination that is necessary to address this particular problem.

Senator **Moynihan**. I am going to say to you that, as much as I share your view that it would be nice if we could keep things out, I don't know that there are going to be many barriers like that left in the world.

What do you think, Mr. Eshenroder? The modes of transportation and such are so intensive in the world today that species are going to be just about anywhere they can live, they are going to be found. Wouldn't you tend to think that?

Mr. **Eshenroder**. I will confine my comments to the fisheries areas. It is extremely difficult in fisheries. There is a major industry, aquaculture, and they sell fish and move them around.

We are working hard also right now in a related area trying to keep a couple of viral diseases of salmon and trout that are on the West Coast out of the Great Lakes.

We are developing right now—I alluded to protocols before. We are developing protocols to try to keep those diseases out. It is very difficult because of the transportation of animals.

Senator **Moynihan**. I guess you have to get used to the idea that all creatures experience ailments. The idea of trout having viral diseases is a new idea to me, but I suppose if you think about it, if people do, trout will. And you have moments of transport. We are here in one of the most critical 20 miles in the geography of North America. It goes from Dunkirk or Angola to Lake Chautauqua. The Indians knew the portage. It is a very gentle portage. It is about 25 miles?

Mr. **Parment**. Less than that.

Senator **Moynihan**. And then you float to the Gulf of Mexico. That's how the French got to what is now Pittsburgh, right? They came up through this part of the world. So it wouldn't take very much to get one of these creatures from here to there, and you can assume it is going to happen. In any event, they are going down the Mississippi right now from Lake Michigan.

On the other hands, we have this marvelously successful work of the Great Lakes Commission. The public never says its thanks very well, but let this Senator thank you, sir, and thank your colleagues.

We'll take the message back. We'll get it formally, anyway, but we need to know from you how you want us to task you. You are there, you are in place, and you have already shown your capacity. We have got to get you money, and we have to get you an assignment—we want you to write your instructions, but we'll go to that. Sir.

Mr. **Parment**. It occurs to me that part of the problem is one that could be responded to with mechanics. The clogging of water intakes becomes one of unclogging them, probably with mechanical means or, as Niagara Mohawk is doing, with thermal means. You can avoid the problem of pesticide overkill in that regard.

In testimony, you mentioned the integrated pest management program, which I am familiar with in agriculture, which basically tries to use natural enemies to the pest you want to get rid of or threshold levels when you apply pesticides. It seems to me the more difficult problem is how you control the fact that these creatures get into the food chain and they thrive and they affect the fish and they get on the fish without some type of pesticide that would be either a naturally occurring, biological enemy of this mollusk, or chemical.

I guess I'd further ask: do you work in these areas now where you try to, in the laboratory, devise microbes that would be in opposition to this mollusk? That is one of the huge new fields in agriculture—through gene-splicing to develop biological organisms—little grubs that attack the other groups. They make them without sex, so they die in a few days. Is there work being done in that area? Are there people geared up to do that work if funding were to be made available?

Mr. ESHENRODER. That work could be pursued. We are just starting to do some of that type of that work in our sea lamprey control program. We have a program that has been in the research phase for some time on sea lampreys and allows sterilization of adult males and then releases them back into the environment where they will spawn with a fertile female. That will essentially remove that female and her reproduction from the spawning stock. So there are those kinds of techniques. Genetic engineering is a very, very new field. There is very little that has been done in fisheries. There has been some work done in it, but it is starting now.

I was pleased to hear of your interest in integrated pest management. The emphasis there initially is not immediately trying to suppress the pest so much as—the first thing you look at is how you can manipulate the system to make pests more tolerable. That's the first thing. If it is still intolerable, then you look for ways of direct suppression or control, as you are familiar with in agriculture. So that's the philosophy that the Commission is operating under now, and if we were to be given charges from the two governments to pursue a program with zebra mussels, we would apply that same philosophy. We are committed to integrated pest management.

Senator MOYNIHAN. That's a fascinating point that Mr. Parment makes. We begin to be able to think of this subject in terms that 30 years ago you wouldn't have even had the language to describe it. But it may just mean we are going to have to alter the genes of this little fellow, and the next thing you know—well, you don't know the next thing. But it is there, and it is what we want you to start thinking about. I like the way you say to first of all try to make the pest tolerable against wiping it off the face of the earth.

Well, gentlemen, we thank you very much. We will look forward to being in touch with all of you. Please don't hesitate—if Great Lakes United would like, we'll take your deposition here as formally from the organization, as it obviously is. If you have further thoughts, write to the committee. We'll very much welcome them. We need them. We will be in touch with you, sir. Again, thank you very much

Mr. WELLER. Thank you.

Mr. ESHENRODER. We are pleased to be here.

Senator MOYNIHAN. Now, our final panel will take us to the world where this is having immediate impact on our water power systems, which is where we are first going to encounter this. The panel consists of: Mr. Robert Henderson, who has an interesting title, the Supervisor of Results of the Niagara Mohawk Corporation; Ms. Remy Del Rosario, who is Assistant Director of the Detroit Water and Sewerage Department, and your own Mr. Michael Bednar, who is the Commissioner of Public Works for the City of Dunkirk.

Here we are, so let's get some hands-on reports. Mr. Henderson, you are first on our list.

What is the Supervisor of Results?

Mr. HENDERSON. It is a position that actually performs duties as anything from plant instruments and controls, the environmental aspects of water quality, air quality, terrestrial ecology, and electronics computer work.

Senator MOYNIHAN. Sounds like something we could use in government.

Mr. PARMENT. We should have a Commission on results.

Senator MOYNIHAN. A Commission on Results.

Go ahead, sir. Proceed exactly as you'd like.

STATEMENT OF ROBERT HENDERSON, SUPERVISOR OF RESULTS, NIAGARA MOHAWK CORP.

Mr. HENDERSON. Thank you, sir.

On October 3d of 1989, Niagara Mohawk's Dunkirk Steam Station was the first facility in the State of New York to encounter the zebra mussels. Unfortunately, we would rather have had better recognition than that.

The Dunkirk Steam Station is a once-through flow of water from Lake Erie via large rectangular cross-section concrete tunnels, providing water for major plant cooling systems at the Dunkirk Steam Station. Maximum flow is 24 million gallons per hour, and 576 million gallons per day. The temperature of that water normally varies from 10 to 15 degrees fahrenheit.

The systems to which cooling water flow is critical are the main steam condensers, the drives for fans supplying combustion air to the furnaces, the drives for pumps feeding water to the boilers, and air compressors. Zebra mussels pose a significant threat to the function of these systems.

By producing a sticky fine root-like appendage called a bissal thread, adult zebra mussels can tightly attach to most surfaces and to each other. In this manner they can build thick, obstructive layers in pipe lines, tunnels, strainers, and heat exchanger tubing. The result is partial or sometimes total restriction of cooling water flow, shutdown of critical equipment, and reduced or total loss of power production from a generating unit.

Loss of generation in this manner can necessitate the purchase of replacement power to satisfy customer demand. Currently, replacement power for the loss of a 200-megawatt unit can cost as much as $5,000 per hour. Only experience will reveal the magnitude of expense involved in cleaning fouled systems. Considering the possible growth in power demand in the Northeast, such occurrences may even contribute to power shortages in the future.

Clearly, zebra mussels pose a serious problem that is not going to go away. Any facility depending on raw water from a source where this creature is thriving must find a way to control the threat. Solutions need to be cost effective and environmentally acceptable, and there is probably no best approach for all locations. Hopefully, programs can be developed that are preventative in nature so that adult mussels will not accumulate to create obstructions. Such programs would require careful monitoring of intake water to determine at what stage of development mussels are entering plant systems and when to apply treatment. Seasonal factors must also be a consideration.

The Dunkirk Steam Station is somewhat unique in that the main condenser cooling water can be recirculated to produce 90 degree fahrenheit temperatures in the system. Exposure to these conditions for a few hours is 100 percent lethal to zebra mussels. Partial success has been achieved with this method, and further refinements to recirculation control should improve the results.

Other methods of control may be the use of chlorine or various available biocides. These chemical treatments are going to require regulatory approval for trial use and careful observation during pilot applications, as there may be adverse environmental effects. Additional oxidizing agents such as ozone, hydrogen peroxide, and potassium permanganate, have also been suggested for possible study. There may be several viable approaches to controlling the zebra mussel problem, but they all require further study. Coating surfaces with materials that the mussels will not bond to is also being investigated.

What is known for sure is that the threat is real, and zebra mussels have no significant natural enemies. Usable control methods must be identified and implemented where necessary as soon as possible, or the worst is yet to come. With various efforts already in progress in the United States and Canada, it appears that some means of coordinating studies and communicating findings would be very desirable, sir.

Senator Moynihan. Very helpful and very direct testimony. The ozone is a potential. The oxidizing agents to have the effect of depriving the organism of the oxygen that it has to have. All these vector techniques are beyond me technically.

Let's hear from Detroit. You are the first large municipality to have to deal with this subject. It is very generous of you to come all this way. We'd like to thank Mayor Colbin for making this possible. We welcome you.

STATEMENT OF REMY DEL ROSARIO, ASSISTANT DIRECTOR, DETROIT WATER AND SEWERAGE DEPARTMENT

Ms. Del Rosario. Thank you, Senator.

On behalf of the Detroit Water and Sewerage Department, I am glad to be given the opportunity to testify at this field hearing on the zebra mussel problem in the Great Lakes and their connecting channels.

The Detroit Water and Sewerage Department supports the inclusion of provisions in title IV of S. 2740 to assist in the research and development of programs to control the zebra mussels and the zebra mussel management program. We believe the bill could be strengthened by addressing ballast water control and by——

Senator Moynihan. I would interrupt for a moment to say to the jury that S. 2740 is the Water Resources Development Act of 1990, as reported. It will be taken up on the floor not next week, but the week after, I hope. So what you have to say is in good time, because we would be able to amend it on the floor if that is what seems to be in order.

Ms. **Del Rosario**. Okay. We believe the bill could be strengthened by addressing ballast water control and by making funds available for distribution to the local level for control of the species.

The issue of ballast water control needs to be addressed, since it is believed that zebra mussels were introduced into the Great Lakes by transoceanic ships discharging ballast water. There is an urgent need to prevent further infestation of the Great Lakes by aquatic nuisance organisms.

Inasmuch as municipalities are more significantly impacted by the zebra mussels problem, funds should be made available for distribution to the local level for control of the species. In addition to future grant programs, we would welcome a retroactive grant program for zebra mussel control to be distributed through States at 50 percent funding to help recover costs already incurred by many affected municipalities.

The Detroit Water and Sewerage Department, to date, has expended half a million dollars for investigation and control of zebra mussels. Because of the size and complexity of our water supply system, the economic impact of zebra mussels on our operation is staggering. We project future operation and maintenance expenditures of at least half a million dollars annually. The high cost of inspection and control of zebra mussels can best be explained by describing our water supply system.

The Detroit Water and Sewerage Department water supply system is the largest in the Nation——

Senator **Moynihan**. Is that so?

Ms. **Del Rosario** [continuing]. In terms of water produced and population served. We supply water to about 4 million people, or approximately 42 percent of the population of Michigan. Our service area covers about 940 square miles in seven counties. We provide service on a retail basis within the City of Detroit, and on a wholesale basis to 119 surrounding communities or governmental entities.

There are five water treatment plants that process raw water from Lake Huron and the Detroit River. These plants pump an average of 630 million gallons a day, and have a combined capacity of about 1.6 billion gallons a day. Of our raw water supply, 85 percent comes from the Detroit River, and 15 percent comes from Lake Huron.

Senator **Moynihan**. Can I just ask a question? The Detroit River flows between Lake Saint Claire and Lake Michigan; is that right?

Ms. **Del Rosario**. Yes.

Senator **Moynihan**. And Lake Saint Claire is where this creature first appeared?

Ms. **Del Rosario**. Yes.

The Detroit Water and Sewerage Department utilizes raw water intakes located at Belle Isle, the Detroit River adjacent to Fighting Island—part of the southwest intake—and within Lake Huron. That's three of them. These intakes have a total of four river tunnels with internal diameters ranging from 10 feet to 16 feet and extending to the shore shaft at distances of from two-thirds of a mile to five miles. The distances from the level of the Detroit River or Lake Huron to the invert of the tunnels range from 126 feet to 196 feet.

A comprehensive inspection of these three intakes was recently completed at a cost of $400,000. Although the inspection showed the presence of zebra mussels in only two of the intakes located in the Detroit River, the extent of infestation is such that it will take at least one more year before any adverse effects will be observed. That's because of the size of our pipes.

Senator MOYNIHAN. Those are big pipes.

Ms. DEL ROSARIO. Yes.

Senator MOYNIHAN. They have diameters ranging from 10 feet to 16 feet.

Ms. DEL ROSARIO. Yes.

Senator MOYNIHAN. But you estimate that in a year you may begin to have an effect?

Ms. DEL ROSARIO. Yes.

Senator MOYNIHAN. Go ahead.

Ms. DEL ROSARIO. We cannot afford to be complacent however. We have built a chlorination facility at the Belle Isle intake, using mostly in-house labor, at a cost of about $100,000. Using sodium hypochlorite, we plan to chlorinate three times a year, each time maintaining a concentration of 0.5 part per million of residual chlorine for seven days.

In order to measure the effectiveness of the system, monitoring for veligers or free-swimming larvae is being done on a daily basis, and underwater inspections are planned to be conducted yearly.

Controlling zebra mussels at the Southwest and Lake Huron intakes will be much more difficult in view of their design and location. Unlike the Belle Isle intake, which is located close to the shore, the Southwest intake structure is located within the Canadian portion of the Detroit River, while the Lake Huron intake crib is submerged in 40 feet of water. These two intakes are not readily accessible; thus, the capital cost involved would be considerably higher than the cost of the Belle Isle intake chlorination facility.

In addition to chemical dosing, we may have to use mechanical methods of removal similar to that employed by the City of Monroe, Michigan, last year. Based on Monroe's experience, this cleaning process is labor-intensive and costly.

The control measures that are now being used by the affected communities are mostly temporary measures. We need more permanent solutions to the zebra mussel problem. This can best be accomplished through the joint effort of industry, academia, and government at all levels. I am pleased to see the situation being addressed at the Federal level.

Thank you for allowing me to talk about this issue that is of great concern to many of us.

Senator MOYNIHAN. It is for us to thank you.

With regards to the two points you make on ballast water control, legislation has been introduced. We took it up in our recent markup of the legislation, but it involves other committees in the House—a whole range of committees—and it would effectively block this legislation for this Congress. So we are moving now on a separate track, and we will get that. Actually, the Canadians are already getting a lot of cooperation, but one extra ship will do all the harm.

On the question of cost sharing in this matter, we have in the bill $25 million for local communities on a 50/50 matching basis. I know that Senator Levin is very much interested in this, and we will be talking about it on the floor. But Monroe, Michigan, had a real problem, didn't it?

Ms. DEL ROSARIO. Yes, they did.

Senator MOYNIHAN. They found that their water supply got clogged up.

Ms. DEL ROSARIO. Yes.

Senator MOYNIHAN. Why don't you tell us? The water pressure fell and they had to close the high schools?

Ms. DEL ROSARIO. What I know about it is that back in December of last year they found that the flow in their intake, which is only about 30 inches in diameter, was restricted up to about 30 percent or so. And then, to add to the problem, they also had ice problems. So those two effectively clogged their intake and they couldn't supply water to their customers.

Senator MOYNIHAN. To their hospitals?

Ms. DEL ROSARIO. To everyone. They had to shut down for several days.

The City of Monroe had to close its high schools and had to close hospitals. Somehow water supply is something you don't think about because you don't see it. It is just when you turn the tap on and nothing happens. But this is heading our way. Even you can imagine next year you are going to have problems with the water moving through ten-foot diameter intakes?

Ms. DEL ROSARIO. Yes.

Senator MOYNIHAN. Next year you——

Ms. DEL ROSARIO. Ten feet is the smallest.

Senator MOYNIHAN. And you will begin to see some consequences in a 10-foot intake?

Ms. DEL ROSARIO. We believe so, unless we do something about it.

Senator MOYNIHAN. Mike, that gives a sense of what we are dealing with.

Sir, tell us what is going on here in Dunkirk.

STATEMENT OF MICHAEL BEDNAR, COMMISSIONER OF PUBLIC WORKS CITY OF DUNKIRK

Mr. BEDNAR. Senator, I thank you for bringing the hearing to Dunkirk and giving me the opportunity to point out a unique and valuable situation that could possibly make a significant contribution to understanding and properly addressing the zebra mussel problem.

The interesting situation is the fact that of two facilities, less than a one-quarter of a mile apart are experiencing drastically different impact. I refer to the Niagara Mohawk Steam Station, which I would describe as severely impacted, and the Dunkirk Filtration Plant, which is minimally impacted. This drastic variation of impact suggests that interesting research data should be available.

Earlier this year, the city met with Doctor Thomas Storch, Director of Environmental Resources Center and associate dean of Natural and Social Sciences of the State University of New York at Fredonia to explore the possibility of establishing a cooperative venture to do research at both the Dunkirk Filtration Plant and the Niagara Mohawk Steam Station.

The ongoing research is extremely limited in scope, due to the lack of any funding whatsoever. Yet, it appears all the parameters are present and available to make a solid contribution to the zebra mussel problem.

Let me review what is readily available here in Dunkirk:

First, the two facilities drastically impacted different, yet only a quarter of a mile apart—one the hydropower plant, the other a municipal water plant.

Two, an extremely active boat harbor.

Three, the State University of New York at Fredonia, which has properly-credentialed personnel to address the zebra mussel problem.

Four, an ongoing—however limited—research project.

I have taken the liberty of contacting everyone concerned regarding the possibility of a cooperative research venture and have received the following assurances:

For the city, Mayor Krauza has authorized the use of our filter plant, along with Chief Operator Jim Sell, and our chemist, Sue Newton.

Further, he has authorized Doctor John Gash, the chief operator of our wastewater treatment plant, who has a PhD in chemistry from MIT, available for consulting.

Two, the State University of New York at Fredonia: Doctor Thomas Storch, Director of the Environmental Resource Center and Associate Dean of Natural and Social Sciences, would expand and head up this cooperative research venture.

From Niagara Mohawk you have Mr. Robert Henderson, who just previously testified before you. Obviously, he has committed Niagara Mohawk's cooperation.

To demonstrate our interest in this problem, all the people I have mentioned are here today and available should your staff be interested in hearing from any of them.

My suggestion and plea is that your committee thoroughly explore the unique situation that is available in Dunkirk and properly fund a research program that would address both facility impaction and inland water cross-pollution of the zebra mussel.

I thank you kindly for the opportunity to make our views known.

Senator MOYNIHAN. Would you help me with the term "cross-pollution."

Mr. BEDNAR. Many boaters from Chautauqua County come and use our boat launch and then use Lake Chautauqua.

Senator MOYNIHAN. And the zebra mussel is in Lake Chautauqua?

Mr. BEDNAR. Yes.

Senator MOYNIHAN. One boat would do it. May I ask if Ms. Newton is here?

Mr. BEDNAR. No. Sue was unable to make it.

Senator **Moynihan**. Are you using some chemicals in your filtration plant?

Mr. **Bednar**. No. Our impact is very slight at this point, Senator. We have not had to take any extreme or unusual measures yet. We are contracted with a consulting firm. We have videotape of our intake line, which is a 36-inch intake line. It is approximately a mile out in the lake. The impaction that we have is relatively minimal.

Senator **Moynihan**. I see. Now, there is something to do with the depth here. The zebra mussel will not flourish at depths of beyond about 40 feet? Does anybody want to help us here?

Ms. **Del Rosario**. No.

Mr. **Bednar**. Doctor Storch can help you, Senator.

Senator **Moynihan**. Doctor Storch.

Mr. **Storch**. They have been located, sir, at depths of 50 to 60 feet.

Senator **Moynihan**. And I think that's what Ms. Del Rosario was going to say.

Ms. **Del Rosario**. We have, as I said earlier, the distances from the level of the Detroit River or Lake Huron to the invert of the tunnels range from 126 feet to 196 feet

Senator **Moynihan**. And you've got zebra mussels?

Ms. **Del Rosario**. We have zebra mussels.

Senator **Moynihan**. There goes that theory. That theory lasted about four minutes. As far as depth goes, as a practical problem you just can't get out where it is too deep. Would that be your judgment, Doctor Storch?

Mr. **Storch**. It depends on the lakes, themselves. We believe that what we are seeing here in the Great Lakes is something different than they have seen in Europe, and so we don't know absolutely how they are going to reside in these lakes here.

Senator **Moynihan**. There may have been a sea change. It is a new ecology over here for the same species, so species change themselves, don't they?

Sir?

Mr. **Giacomo**. I'm Richard San Giacomo. We have just recently completed an inspection at the City of Buffalo with water pipes 70 feet deep, and we have seen a substantial amount there, from one-eighth of an inch to a half inch in size.

Senator **Moynihan**. Half an inch?

Mr. **Giacomo**. One-eighth of an inch to half an inch.

Senator **Moynihan**. To half an inch. We've got your standard eighth-of-an-incher right here. We were talking about this at Niagara Mohawk. Perhaps, Ms. Del Rosario, you have had the longest experience. We probably haven't had zebra mussels in the Great Lakes long enough for them to have reached the largest size they will normally grow to; is that right?

Ms. **Del Rosario**. I believe so.

Senator **Moynihan**. They still have another year or two of growing.

Ms. **Del Rosario**. Yes.

Senator **Moynihan**. They get to be about two inches?

Ms. **Del Rosario**. Almost.

Senator **Moynihan**. Almost two inches. That is big against this fellow here. That could begin to make trouble for a ten-foot pipe.

Ms. **Del Rosario**. Yes.

Senator **Moynihan**. What are you going to do?

Ms. **Del Rosario**. We hope to be able to kill the free-swimming larvae using chlorination. The adults cannot be killed at that concentration of chlorine. We did some studies, and we found that—we submerged an aquarium. We had several mussels. We exposed them to different concentrations of chlorine, and we found that at concentrations of even up to .9 they were alive. After seven days we moved them to fresh water. They were still alive. They stopped eating while we were chlorinating them.

And then they also used 50 parts per million of chlorine, and that's when the adult mussels started to die after two days.

Senator **Moynihan**. So at some concentrations chlorine will do it?

Ms. **Del Rosario**. Yes, but we cannot use 50 parts per million.

Senator **Moynihan**. But if the mussels are drinking it, so are the people in Detroit?

Ms. **Del Rosario**. Yes.

Senator **Moynihan**. Help me on that. I don't know the pharmacology. Would that be an unacceptable dosage?

Ms. **Del Rosario**. It is definitely unacceptable.

Senator **Moynihan**. Is there a dosage of chlorine that would be acceptable?

Ms. **Del Rosario**. The regulations right now call for maintaining a concentration of the treated water at 0.2 parts per million.

Senator **Moynihan**. That's 0.2 parts per million?

Ms. **Del Rosario**. Yes.

Senator **Moynihan**. It was 50 parts per million that worked on the mollusk, but you couldn't accept it in your water supply.

Ms. **Del Rosario**. Right.

Senator **Moynihan**. How common is it for municipal systems to chlorinate their water? Do you do so now at 2 parts per million?

Ms. **Del Rosario**. There are two chlorination stages. The raw water is pre-chlorinated before it is treated with other chemicals, and then it is also chlorinated again before it is transmitted to the different distribution systems. At the pre-chlorination stage we use concentrations of about 1 part per million.

Senator **Moynihan**. Now let me just ask: do you use chlorination here in Dunkirk?

Mr. **Bednar**. Yes, we do, sir.

Senator **Moynihan**. Do we in Buffalo?

Mr. **Giacomo**. It is a common chemical that is used.

Senator **Moynihan**. Yes, sir.

Mr. **Parment**. Unless you get dispensation, you have to do it in New York. You can get dispensation not to

Senator **Moynihan**. You can get dispensation not to. In New York it is, in effect, required. Does New York City do it?

Mr. **Giacomo**. Yes.

Senator **Moynihan**. I didn't know that.

Mr. **Giacomo**. They chlorinate their water.

Senator **Moynihan**. You see I have some education to get through here.

Mr. **Giacomo**. Right now there is a minimum residual that you have to have in your water coming out of the plant to kill all this bacteria in the water. There is no maximum of chlorination, but there is basically an unacceptable maximum, which would give a very distasteful taste to the water and also harm the environment.

Senator **Moynihan**. At some levels you go over a tolerance?

Mr. **Giacomo**. That's correct.

Senator **Moynihan**. I think I have been in some swimming pools that were at that point.

I want to particularly thank you, Ms. Rosario, for coming all the way from Detroit. You were present at the creation of this problem, you might say. I know that Mr. Levin will be particularly pleased because he is very much involved with this issue.

We thank you, sir. And thank you, Mr. Henderson.

With that, we have finished our formal panel, but we have a few moments. If there is anyone in the audience who would like to say something, we'd be very happy to hear from you. We will thank the panel at this point.

The **Reporter**. Do you want this on the record?

Senator **Moynihan**. Yes, if you can do it. We haven't got a great deal of time.

Miss, please come forward.

Participant. I had a question to ask, but it has been answered.

Senator **Moynihan**. You did?

Participant. It was about the life span of the zebra mussels. He said it was five years.

Senator **Moynihan**. You had your question and got your answer. I'm afraid we couldn't have given it to you with any confidence. Come forward and tell us your name.

STATEMENT OF LAURA PAUL, MEMBER, GREAT LAKES COMMISSION

Ms. **Paul**. Hi. I'm Laura Paul. I live in Fredonia, just down Central Avenue. I am a New York member of the Great Lakes Commission.

Senator **Moynihan**. Commissioner, good morning.

Ms. **Paul**. I have been listening to people from various agencies give reports on the zebra mussel since a year ago in March when we were addressed in Washington, D.C. I am delighted to read certain provisions of your bill that look like we are finally going to get started on this.

But there was one thing that wasn't followed up this morning, and for good reason—you had to deal with the things you were dealing with—and that's the matter of tourism.

Senator **Moynihan**. Yes.

Ms. **Paul**. Tourism is such a large industry in this State, and certainly in this particular area. We have put all this money into our harbor. We have all these people from all over the country coming to Chautauqua, but the zebra mussel is going to cut into tourism. It is going to cut into fishing. I don't know to what extent, but I'm sure Mr. Weller's group, as well as Great Lakes Commission, is looking into this.

Senator **Moynihan**. It looks ominous. This thing just eats up all the basic food supply. It just gets in at the very early plankton level, and when that goes the chain doesn't develop.

Ms. **Paul**. I have read about voluntary measures for fishermen to take to wash their boats. I think just as perhaps we are past the stage of voluntary conformance on ballast waters in the proper location, perhaps we have to do something of a stronger nature. I don't know what it should be or how we can do it, but I think it probably has to go beyond the advisory stage of having fishermen bear some responsibility when they are getting their boat from one body of water to another if we are going to try to stem this problem.

Senator **Moynihan**. Commissioner, I don't want to appear more knowledgeable than I am—and it is pretty clear there are limits to my knowledge—but we asked this question at some length at Alexandria Bay, which is a place very much like Dunkirk in that regard, and the fish biologists who were there said that it is hopeless. You could be the most meticulous and committed sportsman and scrub your boat and dry it out and rub it, and somewhere in the corner of the boat there is going to be a quarter inch of water where you can't see it, you can't hear it, but it is going to be there and it is going to have the larvae and it is going to move from one body of water to the other. That's the ecology of the thing.

I guess I think we might as well—it is a given that we have—whatever else, we know it is in the Great Lakes, and we know it will shortly be in the Mississippi system. It has to be in the Hudson today. The Erie water flows through Blackrock, and down it goes to Albany.

What we need are some control systems, and I think—don't you agree that what Mr. Parment said was particularly interesting? Let's try thinking 21st century-like about this and think genetic engineering. What's the point in having the best universities in the world around here if we can't have them do that for us?

But, anyway, we thank you very much. It was thoughtful of you to address yourself.

Yes, sir?

Mr. **Bennice**. Senator Moynihan, looking at——

Senator **Moynihan**. Do you want to come over and sit down like a proper witness, or stand up like you are a jury, whatever you wish?

Mr. **Bennice**. Let me just add my thoughts to the matter. First of all, let me commend you for the rapid legislative initiative that you and other Congressmen have taken to address this issue. However, as I understand the bill, there is some $25 million made available.

Senator **Moynihan**. Everybody needs to live in the real world. That's what we authorized, not what gets appropriated. And the bill hasn't passed yet. I've got to get it passed.

Mr. **Bennice**. This is 50/50 funding?

Senator **Moynihan**. Yes.

Mr. **Bennice**. As a councilman in the City of Dunkirk, I can tell you that the City of Dunkirk, first of all, is the only municipal government that draws its water from Lake Erie in Chautauqua County. For the city residents, to have to pay 50 percent of the cost to address this problem is just totally unfair. It had nothing to do with being responsible for it. I would hope that in the body of this legislation some amendments could be brought about for rural counties and communities such as the City of Dunkirk that would provide a greater amount of direct assistance than 50 percent.

Senator MOYNIHAN. I don't have any difficulty with that, councilman, at all. Money is our problem at all levels of government. But I want to make clear to you—and I think I'd like to hear you, Bill, on this. If I were to ask where this subject will have its most devastating impact if it goes the way we think it is going to go, it will be in the small cities like Monroe, which is a small city that looked up one day and found its water supply was clogged up. The next thing you know, it had to close its hospitals. I have a particular fondness for the Erie Canal. You go along the Erie, which is beautiful. Since we cleaned up the water, the canal was cleaned up. So these small towns are beautiful towns, and they get their water from the canal. The canal is also a great irrigation system too, you know. Well, those systems clogged up like that. Our guest witnesses today might want to look at a pipe filled with zebra mussels. It is right here. That can happen in a year, and then you are just in awful trouble.

I don't know how to respond except to say that the money we assume will be 50 percent Federal and 50 percent State. It will cost Dunkirk money before it is over. You might as well live with that, sir.

Mr. PARMENT. Let me just add, Senator, that the State budget this year, through the efforts of our State Senator, Jess Parsan, includes for the City of Dunkirk some $50,000 to deal with this. This is probably the first State appropriation for this work.

Senator MOYNIHAN. Really?

Mr. PARMENT. But I think that the problem you anticipated is that of the small communities that don't have a 10- or 16-foot diameter water intake. When that problem impacts these communities, it probably will come in a glurg, if you will, and we will all be hard pressed to come up with the money. Some communities take water from the lake for their drinking water.

Now, you have been at Chautauqua Institution, which is one of those communities. I can't imagine that their water intake is much more than 24-inch diameter. I suspect it is less than that. And I suspect that when the zebra mussel gets to the inland lakes, those pipes will clog very quickly.

I guess on the positive side of that is that it would be less costly for them to lay a new pipe than it would be for Detroit to put one in at 16 feet diameter to replace the one they currently have.

But I see a potential here for the State and Federal Governments to aid communities in building redundant systems so that one system could be in operation while the other is mechanically cleaned. I suspect that we are going to have to address this in future—and not too far in the future—budgets of the State and the Federal Government.

Senator MOYNIHAN. I think you are right. I think we are also going to have to learn a lot more about how they handle it in Europe, don't you think? On the other hand, we may have a different creature out here.

In any event, we are besieged of the issue. We are legislating—in Albany already you have legislated. We are going to legislate in Washington. We are going to work with the Canadians.

We are not in any way on top of this, but neither are we acting as if it hasn't happened. Let us hope that we have some of the kind of success we had with the sea lamprey. You could have thought 20 years ago that there goes Lake Erie, but no.

I'll tell you what: we all agree we are going to turn out to be smarter than these creatures. That's the way to do it.

Mr. Mayor, once again thank you, sir, for letting your facilities be available to the committee. We appreciate that. We appreciate our reporter. I'd like to thank Mr. White and Mr. French who have staffed all of this. Thank you all for being such an attentive and helpful audience.

With that, our hearing is closed. Again, I thank my colleague and friend, Assemblyman Parment, who is there for you. When we got to Niagara Mohawk this morning, Bill Parment was there.

[Applause.]

[Whereupon, at 12:13 a.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Statements submitted for the record follow:]

STATEMENT ON PROPOSED GLFC ROLE IN MANAGING THE EXOTIC ZEBRA MUSSEL

To Senator Daniel Patrick Moynihan

Dunkirk, New York
22 June 1990

Randy Eshenroder, Senior Scientist
Great Lakes Fishery Commission

In speaking on behalf of the Great Lakes Fishery Commission regarding its potential role in the management and control of zebra mussels as proposed by Senator Moynihan, my testimony must be characterized as preliminary because not all Commissioners have had adequate opportunity to discuss this important matter. However, the Commission is prepared to carry out to the best of its ability any charges given it by the U.S. and Canadian Governments. Our preliminary conclusions on how we would conduct a program follow.

Although the Commission would almost certainly approach the problem with broad-based, information-needs-determining workshops, followed by requests for proposals (RFP's) and research contracting, there are certain immediate needs which would be addressed concurrently with a granting process. These immediate needs would include reviews of literature, support for molluscicide registration research, transfer of available information, and establishment of protocols for containment of zebra mussels to the Great Lakes. Literature reviews and research on molluscicide registration would be accomplished through contracts with government or academic researchers, whereas information transfer, containment protocols, and the granting process would be conducted internally. These latter activities would entail the addition of at least 4 staff (a coordinator, contract manager, information specialist, and secretary).

Control of zebra mussel infestations on infrastructures, especially water intakes, is very important. Information on the zebra mussel's biology and ecology is required as a priority in order to determine its vulnerability to control measures. Experts from universities, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration (and Canadian counterparts) would be consulted and their conclusions published. The Commission has an enviable record in developing and disseminating research. Requests for proposals on mussel biology and ecology would be circulated and contracts issued subject to peer review and recommendation by scientific panel(s).

Control technology information needs would be similarly determined and published using integrated pest management principles to which the Commission subscribes in its sea lamprey control program. Input would be sought from entities such as the Corps of Engineers, the Electric Power Research Institute, Ontario Hydro, the USFWS, academia, the states and province. Once again, requests for proposals would be circulated and contracts issued subject to peer review and recommendation by scientific panel(s). The Commission sees information transfer as an integral part of its current mandate. However, given the magnitude of information transfer needs, and the Convention charge to use government agencies (when feasible) in performance of duties, the Commission would likely establish an information transfer network to maximize its effectiveness.

Quantifying ecological impacts of the zebra mussel in the Great Lakes would be a first objective of the workshop/RFP/granting process. If needed, control technology for the open waters would be the second objective. Input would be sought from community ecologists in the USFWS, NOAA, universities, and their Canadian counterparts in documenting and meeting information needs. A need for the Commission to engage in hands-on control for the open waters is a decision the Governments would make based on the demands of the technology, the situations to be addressed, and the capacity of existing entities to mount an effective, efficient control program.

With regard to inland areas beyond the Commission's jurisdiction, our role would likely be limited to development of protocols to contain the spread of zebra mussel. In addition, of course, information gained from the Great Lakes experience would be shared with other potentially affected parties.

Preliminary estimates of costs for fiscal year 1990 operations total $1,050,000. The $6 million estimate for subsequent years was based on existing U.S. contributions for sea lamprey control and can be adjusted upward or downward depending on perceptions of the seriousness of the problem, and the speed with which solutions are needed.

The selection of the Great Lakes Fishery Commission to assume an expanded role in addressing problems with introduced pests in the Great Lakes Basin has advantages as follows:

1) Our jurisdictional responsibilities include the entire Great Lakes and tributaries;

2) The Commission represents both Canada and the U.S.;

3) We are involved in a research and control program on another aquatic nuisance, the sea lamprey. As a part of this program, we have experience, personnel, and facilities (Rogers City, Luddington, Marquette, and Sault Ste. Marie, Michigan and Ontario) that already deliver a successful pest program;

4) We have an infrastructure of committees that includes a variety of institutions on the Great Lakes including federal, state, provincial, and tribal natural resource agencies, academic institutions, and the public;

5) The Commission is already being asked by state and provincial fishery management agencies to take a leadership role with respect to exotics such as the ruffe, spiny water flea, and zebra mussel.

If either Canada or the United States wishes to use the Commission, any consultation should be bilateral and consider the following ramifications:

1) In order for the Commission to address non-fish concerns associated with exotics (such as zebra mussel impacts on water intakes, native clams, etc.), the two countries could add to the 1955 Convention on Great Lakes Fisheries a reference charging the Commission to advise Governments on issues pertaining to "aquatic organisms of common concern", as well as to fish stocks of common concern.

2) The Commission could be charged to address non-fish, non-pipe impacts (such as those possibly inflicted by zebra mussel on native clams), by invoking a broad (ecosystem approach) interpretation of the existing Convention if both countries agreed.

3) If Governments wish the Commission to engage in hands-on control of exotics other than sea lamprey, a revision to the Convention to minimize and eradicate species other than sea lamprey would be required.

4) If the two countries agree to use the GLFC in responding to exotics, they can ask the Commission for a recommendation on cost sharing, as occurred when the original 69:31 (sea lamprey) and 50:50 (administration) funding ratios were established.

Thank you for the opportunity to speak on behalf of the Great Lakes Fishery Commission.

22 June 1990

Attachment 1

VERY PRELIMINARY
SCHEDULE FOR GLFC RESPONSE TO ZEBRA MUSSEL INVASION
UNDER ZEBRA MUSSEL CONTROL ACT OF 1990

STARTS	ACTION	U.S. COST
Year one		
10/1/90	literature reviews	$ 150,000
10/1/90	molluscicide registration	$ 300,000
10/1/90	hiring staff	$ 250,000
10/1/90	office costs	$ 50,000
10/1/90	containment protocols	inhouse
10/1/90	information transfer	inhouse
12/90	workshop(s) basic biology control technology ecological impacts	$ 300,000
6/91	RFP's issued	inhouse
8/91	proposals due	inhouse
8-9/91	peer review	volunteer
		$1,050,000
Year two		
11/91	contract research	$4,000,000
6/92	pilot control projects	$1,500,000
	(continued staff and coordination costs)	$ 500,000
		$6,000,000

Great Lakes United

STATEMENT OF
PHILIP E. WELLER
TO
SENATOR DANIEL PATRICK MOYNIHAN
FIELD HEARING ON ZEBRA MUSSELS
DUNKIRK, NEW YORK
JUNE 23, 1990

Good Morning. My name is Philip E. Weller, and I am Executive Director of Great Lakes United, a binational coalition of over 180 groups from throughout the Great Lakes - St Lawrence River ecosystem. Our membership -- which includes environmental organizations, community groups, unions, small businesses, academic and scientific groups, hunters, anglers, boaters, and governmental bodies -- extends from Duluth at the western end of the basin to Quebec City along the St Lawrence River outflow of the system. This statement is made on behalf of this community of organizations who are deeply concerned about the condition of the Great Lakes ecosystem.

I would like to thank Senator Moynihan for the opportunity to testify here today. During this presentation, I would like to convey three essential messages. The first of these is that there is an urgent need to prevent the introduction of exotic species into the Great Lakes. Secondly, zebra mussels have infested the Great Lakes and there is a need for action to monitor and respond to the threat posed by this tiny invader. And third, it is imperative that, in controlling the zebra mussels, we do not introduce cures that are worse for the health of the Great Lakes and the people who live here than the disease we are trying to manage.

I would like to address each of these three main points in turn.

The introduction of the zebra mussel into the Great Lakes was preventable. Once in the Great Lakes, the zebra mussel and other exotic species are difficult if not impossible to control. The best and most effective method of addressing the problem of introduction of exotic species into the Great Lakes is to simply prevent them from ever getting here. While the door cannot be shut on the zebra mussel, the door can be shut on other potentially damaging organisms that could be introduced to the Great Lakes. The zebra mussel dilemma we are now faced with can and should be a powerful message to us of the difficulty of addressing problems once they are in the lakes. Like toxic chemicals which cannot be mopped up once they are in the lakes, exotic species must be prevented from entering the system.

An international organization dedicated to conserving and protecting the Great Lakes and St. Lawrence River"
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To prevent introductions or spread of exotics, foreign ships have been asked to voluntarily exchange their ballast water in the open seas or in the Gulf of St. Lawrence. The 83% voluntary compliance rate is encouraging (but 173 ships annually are not complying). It only takes one ship to introduce a pest such as the zebra mussel. It is therefore imperative that there be a mandatory ballast exchange program and rigorous monitoring system to ensure compliance. Such a program must be coordinated with Canadian shipping authorities. Only through prevention will we truly be able protect the Great Lakes from the damaging impacts of exotic species.

Other speakers here today will outline for you the extent of the zebra mussel invasion, and I don't need to do that for you. What I would like to point out is the desperate need for research on the distribution, spread, and possible control of the zebra mussel. Strategies to effectively manage the zebra mussel problem cannot be undertaken out of ignorance. It is imperative that there be substantial resources and research efforts devoted to learning about zebra mussels. From our conversations with sportsmen, university researchers and government scientists, it is clear that there is a great deal that is not known about the zebra mussel, and there is a compelling need to fund research directed towards an expansion of our understanding. It is particularly important that we maintain basic survey information on the distribution and abundance of the zebra mussels throughout the Great Lakes. Research on the life cycle, habitat preferences, and impact on other organisms are extremely important. Finally, we need to be undertaking research on possible controls.

Europeans have learned to cope with the zebra mussel, and we need to turn to them for possible insights into our own problem. Two areas are particularly worthy of our research effort. These are:

1. Ballast treatments that are environmentally sound and effective; and

2. Environmentally sound mussel removal methods for water intakes and boat hulls.

Finally, I would like to stress that it is imperative that the solutions adopted (if there are any) must not contribute to, or create, other equally or more damaging impacts elsewhere in the ecosystem. For example, chlorination and other chemical control methods have been proposed for water intakes and other problem areas. These approaches should be treated cautiously. Available evidence indicates that chlorination of water intakes may cause the formation of trihalomethanes. These halomethanes are potentially carcinogenic and could affect the quality of drinking water.

We are concerned as well that the extensive use of poisons to control zebra mussels will kill or damage populations of native organisms. A company in Ohio, for example, recently applied for a permit to chemically control zebra mussels at a Lake Erie power plant. The proposal was made without full documentation of the need for control at that site and without exploration of physical cleaning or other non-chemical approaches. The zebra mussel is a significant threat to the health of the Great Lakes ecosystem but we cannot loose sight of the fact that control must not damage the ecosystem in other ways. We cannot approach the zebra mussel dilemma with a "kill the clams - but damn everything else" attitude.

In conclusion, I would again like to thank Senator Moynihan for the opportunity to present this testimony and look forward to the success of our collective efforts to conserve and protect the Great Lakes ecosystem.

STATEMENT OF ROBERT HENDERSON

NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/DUNKIRK STEAM STATION, 106 POINT DRIVE NORTH, DUNKIRK, NY 14048

A once through flow from Lake Erie, via large rectangular cross section concrete tunnels, provides water for all major plant cooling systems at Dunkirk Steam Station. Maximum flow is 24,000,000 gallons per hour and water normally exits 10-15 degrees F warmer than it enters.

The systems to which cooling water flow is critical are the main steam condensers, the drives for fans supplying combustion air to the furnaces, the drives for pumps feeding water to the boilers, and compressors providing air for control and soot blowing functions. Zebra Mussels pose a significant threat to the function of these systems.

By producing a sticky fine root like appendage called a bissal thread, adult Zebra Mussels can tightly attach to most surfaces and to each other. In this manner they can build thick obstructive layers in pipe lines, tunnels, strainers, and heat exchanger tubing. The result is partial or sometimes total restriction of cooling water flow, shut down of critical equipment, and reduced or total loss of power production from a generating unit.

Loss of generation in this manner can necessitate the purchase of replacement power to satisfy customer demand. Currently, replacement power for the loss of a 200 megawatt unit can cost as much as $5,000 per hour. Only experience will reveal the magnitude of expense involved in cleaning fouled systems. Considering the possible growth in power demand in the Northeast, such occurances may even contribute to power shortages in the future.

Clearly, Zebra Mussels pose a serious problem that is not going to go away. Any facility depending on raw water from a source where this creature is thriving, must find a way to control the threat. Solutions need to be cost effective and environmentally acceptable; and there is probably no one best approach for all locations.

Hopefully, programs can be developed that are preventative in nature, so that adult mussels will not accumulate to create obstructions. Such programs would require careful monitoring of intake water to determine at what stage of developement mussels are entering plant systems and when to apply treatment. Seasonal factors must also be a consideration.

The Dunkirk Steam Station is somewhat unique in that main condenser cooling water can be recirculated to produce 90+ degree F temperatures in the system. Exposure to these conditions for a few hours is 100% lethal to the Zebra Mussels. Partial success has been achieved with this method and further refinements to recirculation control should improve the results.

Other methods of control may be the use of chlorine or various available biocides. These chemical treatments are going to require regulatory approval for trial use and careful observation during pilot applications, as there may be adverse environmental effects. Additional oxidizing agents such as ozone, hydrogen peroxide, and potassium permanganate have been suggested for possible study.

There may be several viable approaches to contolling the Zebra Mussel problem, but they all require further study. Coating surfaces with materials that the mussels will not bond to is also being investigated.

What is known for sure is that the threat is real and Zebra Mussels have no significant natural enemy. Useable control methods must be identified and implemented where needed as soon as possible, or the worst is yet to come.

With various efforts already in progress in the United States and Canada, it appears that some means of coordinating studies and communicating findings would be very desireable.

Detroit Water and Sewerage Department
Water Board Building
Detroit, Michigan 48226
(313) 224-4800

Coleman A. Young, Mayor
City of Detroit

TESTIMONY OF REMEDIOS K. DEL ROSARIO, ASSISTANT DIRECTOR OF WATER SUPPLY OPERATIONS, DETROIT WATER & SEWERAGE DEPARTMENT, BEFORE THE SENATE'S ENVIRONMENT & PUBLIC WORKS SUBCOMMITTEE ON WATER RESOURCES, TRANSPORTATION AND INFRASTRUCTURE, CONCERNING S. 2740, THE WATER RESOURCES DEVELOPMENT ACT OF 1990

JUNE 23, 1990

On behalf of the Detroit Water & Sewerage Department, I am glad to be given the opportunity to testify before the Subcommittee on Water Resources, Transportation and Infrastructure on the zebra mussels problem in the Great Lakes and their connecting channels.

The Detroit Water and Sewerage Department supports the inclusion of provisions in Title IV of S. 2740 to assist in the research and development of programs to control zebra mussels and the zebra mussel management program. We believe the bill could be strengthened by addressing ballast water control and by making funds available for distribution to the local level for control of the species.

The issue of ballast water control needs to be addressed since it is believed that zebra mussels were introduced into the Great Lakes by transoceanic ships discharging ballast water. There is an urgent need to prevent further infestation of the Great Lakes by aquatic nuisance organisms.

Inasmuch as municipalities are more significantly impacted by the zebra mussels problem, funds should be made available for distribution to the local level for control of the species. In addition to future grant programs, we would welcome a retroactive grant program (for zebra mussels control) to be distributed through states, at 50% funding, to help recover costs already incurred by many affected municipalities.

The Detroit Water & Sewerage Department (DWSD), to date, has expended half a million dollars for investigation and control of zebra mussels. Because of the size and complexity of our water supply system, the economic impact of zebra mussels on our operation is staggering. We project future operation and maintenance expenditures of at least half a million dollars annually. The high cost of inspection and control of zebra mussels can best be explained by describing our water supply system.

The DWSD water supply system is the largest in the nation in terms of water produced and population served. We supply water to about 4 million people, or approximately 42% of the population of Michigan. Our service area covers about 940 square miles in seven counties. We provide service on a retail basis within the City of Detroit and on a wholesale basis to 119 surrounding communities or governmental entities.

There are five treatment plants that process the raw water from Lake Huron and the Detroit River. These plants pump an average of 630 MGD and have a combined capacity of about 1.6 BGD. Eighty-five percent of our raw water supply comes from the Detroit River and 15% comes from Lake Huron.

The DWSD water supply system utilizes raw water intakes located at Belle Isle, in the Detroit River adjacent to Fighting Island (Southwest Intake) and within Lake Huron. These intakes have a total of four river tunnels with internal diameters ranging from 10 feet to 16 feet and extending to the shore shaft at distances of from two-thirds of a mile to 5 miles. The distances from the level of the Detroit River or Lake Huron to the invert of the tunnels range from 126 feet to 196 feet.

A comprehensive inspection of these three intakes was recently completed at a cost of $400,000. Although the inspection showed the presence of zebra mussels in two of the intakes located in the Detroit River, the extent of infestation is such that it will take at least one more year before any adverse effects will be observed.

We cannot afford to be complacent however. We have built a chlorination facility at the Belle Isle Intake, using mostly in-house labor, at a cost of about $100,000. Using sodium hypochlorite, we plan to chlorinate three times a year, each time maintaining a concentration of 0.5 ppm of residual chlorine for 7 days. In order to measure the effectiveness of the system, monitoring for veligers or free swimming larvae is being done on a daily basis and underwater inspections are planned to be conducted yearly.

Controlling zebra mussels at the Southwest and Lake Huron Intakes will be much more difficult in view of their design and location. Unlike the Belle Isle Intake which is located close to the shore, the Southwest Intake structure is located within the Canadian portion of the Detroit River while the Lake Huron Intake crib is submerged in 40 feet of water. These two intakes are not readily accessible. Thus, the capital cost involved would be considerably higher than the cost of the Belle Isle Intake chlorination facility.

In addition to chemical dosing, we may have to use mechanical methods of removal similar to that employed by the City of Monroe, Michigan last year. Based on Monroe's experience, this cleaning process is labor-intensive and costly.

The control measures that are now being used by the affected communities are mostly temporary measures. We need more permanent solutions to the zebra mussel problem. This can best be accomplished through the joint effort of industry, academia, and government at all levels. I am pleased to see the situation now being addressed at the federal level.

Thank you for allowing me to talk about this issue that is of great concern to many of us.

U. S. SENATE HEARING FIELD HEARING
JUNE 23, 1990
-OPENING STATEMENT-
DIRECTOR OF PUBLIC WORKS
CITY OF DUNKIRK

Mike Bednar

SENATOR, I THANK YOU FOR BRINGING THE HEARING TO DUNKIRK AND GIVING ME THE OPPORTUNITY TO POINT OUT A UNIQUE AND VALUABLE SITUATION THAT COULD POSSIBLY MAKE A SIGNIFICANT CONTRIBUTION TO UNDERSTANDING AND PROPERLY ADDRESSING THE ZEBRA MUSSEL PROBLEM.

THE INTERESTING SITUATION IS THE FACT OF TWO FACILITIES LESS THAN A ¼ (QUARTER) OF A MILE APART EXPERIENCING DRASTICALLY DIFFERENT IMPACT. I REFER TO THE NI-MO STEAM STATION WHICH I WOULD DESCRIBE AS SEVERELY IMPACTED. THE SECOND, THE DUNKIRK FILTRATION PLANT IS MINIMALY IMPACTED.

THIS DRASTIC VARIATION OF IMPACT SUGGESTS THAT INTERESTING RESEARCH DATA SHOULD BE AVAILABLE.

EARLY THIS YEAR, THE CITY MET WITH DR. THOMAS STARCH, DIRECTOR, ENVIRONMENTAL RESOURSES CENTER AND ASSOCIATE DEAN OF NATURAL AND SOCIAL SCIENCES, TO EXPLORE THE POSSIBILITY OF ESTABLISHING A CO-OPERATIVE VENTURE TO DO RESEARCH AT BOTH THE DUNKIRK FILTRATION PLANT AND NI-MO STEAM STATION.

THE ON GOING RESEARCH IS VARY LIMITED IN SCOPE DUE TO THE LACK OF ANY FUNDING WHATSOEVER. AND YET, IT APPEARS THAT ALL THE CONCRETE PARAMETER ARE PRESENT AND AVAILABLE TO MAKE A SOILD CONTRIBUTION TO THE ZEBRA MUSSEL PROBLEM.

LET ME REVIEW WHAT IS READILY AVAILAVLE HERE IN DUNKIRK:

1. TWO FACILITIES INPACTED DRASTICALLY DIFFERENT, YET

ONLY A ¼ MILE APART .

(1) A HYDRO POWER PLANT, THE OTHER A MUNICIPAL WATER PLANT.

2. AN EXTREMELY ACTIVE BOAT HARBOR.
3. SUNY FREDONIA WHICH HAS PROPERLY CREDENTIALLED PERSONNEL TO ADDRESS THE ZEBRA MUSSEL PROBLEM.
4. AN ONGOING, HOWEVER LIMTED, RESEARCH PROJECT.

I HAVE TAKEN THE LIBERTY OF CONTACTING EVERYONE CONCERNED REGARDING THE POSSIBILITY OF A CO-OPERATIVE RESEARCH VENTURE AND HAVE RECEIVED THE FOLLOWOING ASSURANCES:

1. THE CITY -MAYOR KRAUZA HAS AUTHORIZED THE USE OF OUR FILTER PLANT, PER SE ALONG WITH OUR CHIEF OPERATOR, JIM SELL AND CHEMIST, SUSAN NEWTON.

FURTHER, HE, AUTHORIZED DR. JOHN GASH, THE CHIEF OPERATOR OF OUR WASTE WATER TREATMENT PLANT WHO HAS A PHD IN CHEMISTRY FROM M I T , AVAILABLE FOR CONSULTING.

2. THE STATE UNIVERSITY OF NEW YORK AT FREDONIA

DR. THOMAS STARCH, DIRECTOR, ENVIRONMENTAL RESOURCE CENTER AND ASSOCIATE DEAN OF NATURAL AND SOCIAL SCIENNCES, WOULD EXPAND AND HEAD-UP THIS CO-OPERATIVE RESEARCH VENTURE.

3. NI-MO - MR. ROBERT HENDERSON

WHO ADDRESSED YOU EARLIER, HAS COMMITTED NI-MO'S CO-OPERATION.

TO DEMONSTRATE OUR INTEREST IN THIS PROBLEM , ALL THE PEOPLE I HAVE MENTIONED ARE HERE TODAY AND AVAILABLE SHOULD YOUR STAFF BE INTERESTED IN HEARING FROM ANY OF THEM.

MY SUGGESTION AND PLEA, IS THAT YOUR COMMITTEE THOROUGHLY EXPLORE THE UNIQUE SITUATION THAT IS AVAILABLE IN DUNKIRK AND PROPERLY FUND A RESEARCH PROGRAM THAT WOULD ADDRESS BOTH - FACILITY IMPACTION AND INLAND WATER CROSS-POLLUTION OF THE ZEBRA MUSSEL.

I THANK YOU KINDLY FOR THOPPOTUNITY TO MAKE OUR VIEWS KNOWN.

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